DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

NOVEMBER, 1952 VOLUME 50 • NUMBER 11

CONTENTS

COMING SOON

Use of radioactivity to explore the behavior of brighteners in silver solutions.

An article on the radiometric evaluation of the effectiveness of the chromic acid rinse treatment for phosphated work.

The use of lead-clad copper cooling coils in the anodizing of aluminum at one of the leading aircraft engineering companies.

Founded as Metal Industry, January, 1903
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The WASHINGTON OBSERVER

Charles A. Cerami

News and Views from The Nation's Capitol

. There is no prospect, at this time, of continuing sufficient raw materials of copper to provide for an expanded civilian demand added to anticipated military demands and the resumption of stockpiling, according to government officials. Copper producers have suggested that the situation would be helped if prices of domestic copper were decontrolled.

. October allocation quotas of refined copper to industry are less than the monthly average for the period of August 1951 through June 1952, due to a decrease in availability of both domestic and foreign refined copper for the production of controlled material products, says NPA.

. The Office of Civilian Requirements has been abolished and its functions and staff are being transferred to the new office of Distribution, Dept. of Commerce and to a new Civilian Requirements Division in NPA's Policy Coordination Bureau.

. Production of primary and secondary cadmium in July was 4 percent above June output, according to the Bureau of Mines. Total output for the month was 734,364 lbs. compared with 704,150 lbs. in June and a monthly average of 687,575 lbs. in 1951.

. In anticipation of improved supplies of steel, the NPA has notified auto manufacturers that it is authorizing a first quarter 1953 level of production of at least 1,250,000 cars and 315,000 trucks, the highest so far since inauguration of the Controlled Materials Plan.

. Development of one of the largest copper deposits ever discovered in the United States is assured by the signing of a floor-price purchase contract recently with the San Manuel Copper Corp. The company has vast copper holdings in Pinal County, Arizona.

. The post-strike emergency directives restricting tinplate distribution for food packing uses has been revoked. In an amendment to NPA order M-24, wider use of terneplate is permitted to counteract the sluggish movement of existing stocks. Removal of end-use restrictions on terneplate makes it available as a possible substitute for other coated materials such as galvanized sheets. However, restrictions on the amount of tin used to make the terneplate have not been changed.

. U.S. production of primary aluminum set a new postwar record during August, according to an announcement of the Aluminum Association. An increase of 15.5 percent over output in August of last year could probably have been greater had there not been power shortages.

. Prohibition against use of cobalt and cobalt derivatives in the production of porcelain enamel signs was removed in an amendment to Schedule 2 of M-80.

. In a short-term deal covering Bolivian tin now stockpiled at Peruvian and Chilean ports, the U.S. agreed to buy 6,000-7,000 long tons of the metal from the Bolivian government at an agreed upon price of $1.175 per lb. The Bolivians sought, unsuccessfully, to sell us 18,000 tons on a one-year contract. Uncertainty over their government's announced policy of nationalizing mines resulted in the offer being turned down.

. A new application form has been issued by NPA which makes available a standard form, for the first time, on which a firm may apply for priorities assistance to meet a special situation in which there is urgent need for delivery of material or equipment at a date earlier than is possible under normal delivery schedules.

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ESTABLISHED 1903

METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

VOLUME 50 • NUMBER 11 • NOVEMBER 1952

Our Most Precious Asset

Per pound, per gallon or per cubic foot it is our cheapest operating chemical by far, yet our most important. Too often, its purity has been a factor of minor concern, its availability a matter of blissful assumption, its use an example of prodigious waste and its disposal a problem of growing proportions. Like all good things which come from above we have gotten to take it for granted.

Every one of us has probably speculated idly at one time or another about what would happen to the electroplating industry were it to be deprived of a plentiful supply of common H_2O. It's been pouring steadily for eight hours now and, sitting on a hilltop in the watershed area watching the torrents rush down into the valley, our thoughts start following the water as it fills and overflows the reservoirs, one stream to flow into the rivers and out to sea, the other directed into aqueducts to serve, among others, the plating shop to which it is life blood.

Our mind speculates on the way Nature is wasting this rainfall; a relatively minute amount used to satisfy needs and the balance returned to the ocean to complete an endless cycle. Then appear mental pictures of rinse tanks overflowing continuously and degreaser condensing units draining directly into the sewers. From somewhere deep in our brain we recall figures like 80 billion gallons of industrial water a day being used for processing in 1950 and 100,000 gallons of water used to produce a ton of rolled steel, then the recent warning of a Presidential Commission that most sections in the arid West and some sections in the manufacturing belt of the East are reaching the limit of pure water supplies.

The rain will eventually die down to a light drizzle, then the sun will be out again and the flow of water in the streams will again slow down to a trickle until next time. In our mental picture, however, we see the overflowing rinse tanks still pouring our most precious asset down the drain and eventually out to sea, just as Nature has been doing for countless ages. Perhaps Nature can afford to be wasteful but can we?

Nathaniel Hall

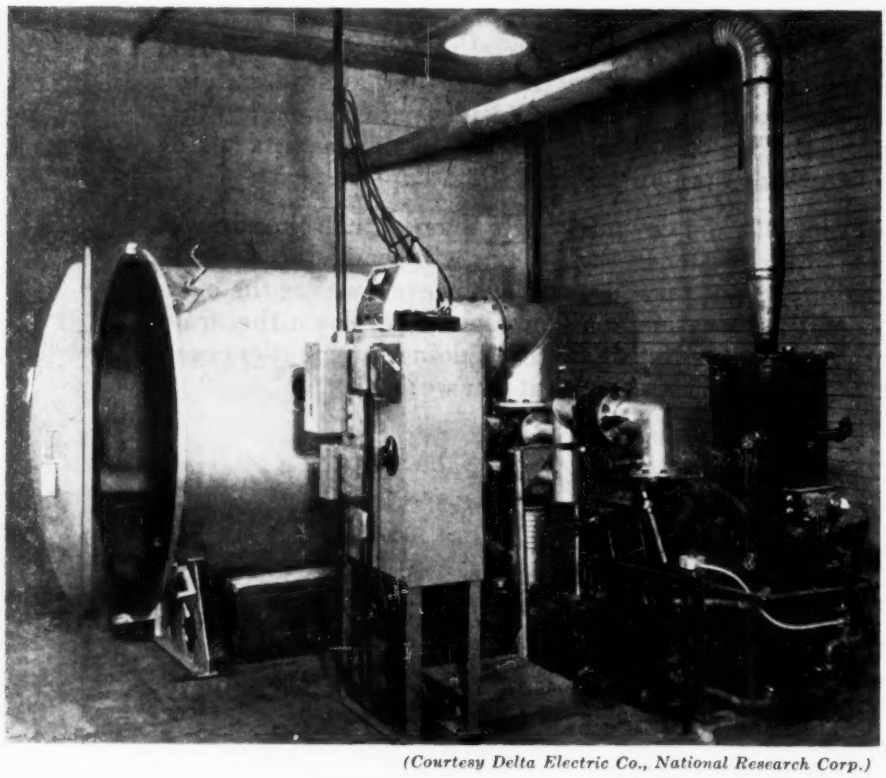
Economical Finishing With Vacuum Metalizing

By George W. Carr, *National Research Corporation, Cambridge 42, Mass.*

PRACTICAL methods of applying thin, mirror-finish layers of metal to plastic, glass and metal surfaces on a production scale are opening new opportunities for manufacturers to finish and decorate their products. The new finishes give a rich appearance that the operator can vary within a wide range of pleasing effects. New production-scale equipment and methods reduce costs by raising production rates and make this the most economical method of applying a bright metallic finish to articles of metal, glass or plastics. And the new methods open new markets and substantially widen existing ones for articles that modern fabricators can make cheaply. The basic process is to apply a thin metal film in a very high vacuum. This process, perfected during World War II for making precision mirrors for fine optical instruments and for overcoming the reflection from the surfaces of lenses and prisms, required unusual laboratory equipment which has subsequently been simplified and enlarged to operate on a production scale at low cost. Now vacuum metalizing is more efficient and more economical than any other method of finishing small parts with bright metal coatings, and its applications extend over a wider range.

The actual operation of the process is simple. Now that vacuum equipment has been perfected for fast operation on a production scale, the operator has no problems beyond those inherent in handling large numbers of small parts. Only three operations are necessary: (1) the articles to be finished are given an organic coating to provide a mirror-smooth surface to carry the thin metal layer; (2) the metal film is applied in the high vacuum chamber by evaporation of the metal from a heated filament; and (3) a final protective organic coating is applied to prevent injury to the thin metal film in use.

The initial layer may be, and usually is, a baked alkyd resin and is applied to smooth the surface of the pieces. It replaces the more expensive and less effective polishing operation that is required in preparing metal surfaces for electroplating. Often this is more practical than the production of a mirror smooth surface on plastics by die finishing. If the parts are produced with highly finished surfaces, the lacquer coating may be omitted, but under other circumstances experience has shown that an organic coating applied by dipping and baking yields a smoother surface at less cost than any other method. By the proper choice of a coating material of the right spreading characteristics, the operator can easily produce a highly reflective surface on an unpolished piece of metal that has been die cast, drawn or spun. The nature of the metal, whether it is brass, copper, steel, aluminum or other metal, has no significance in the treatment. The coating has the power to fill small depressions in the surface and to dry to a smooth film that is at the same time deep enough to cover any slight projections from the metal surface. The objective is to secure a smooth surface and to bake the finish to cure it and to remove any solvent or other constituent that would interfere



(Courtesy Delta Electric Co., National Research Corp.)

Figure 1. Vacuum metalizing equipment comprises three essential units: vacuum cylinder (left) 5½ feet in diameter by 4 feet long; electrical controls (center); and vacuum pumps (right).

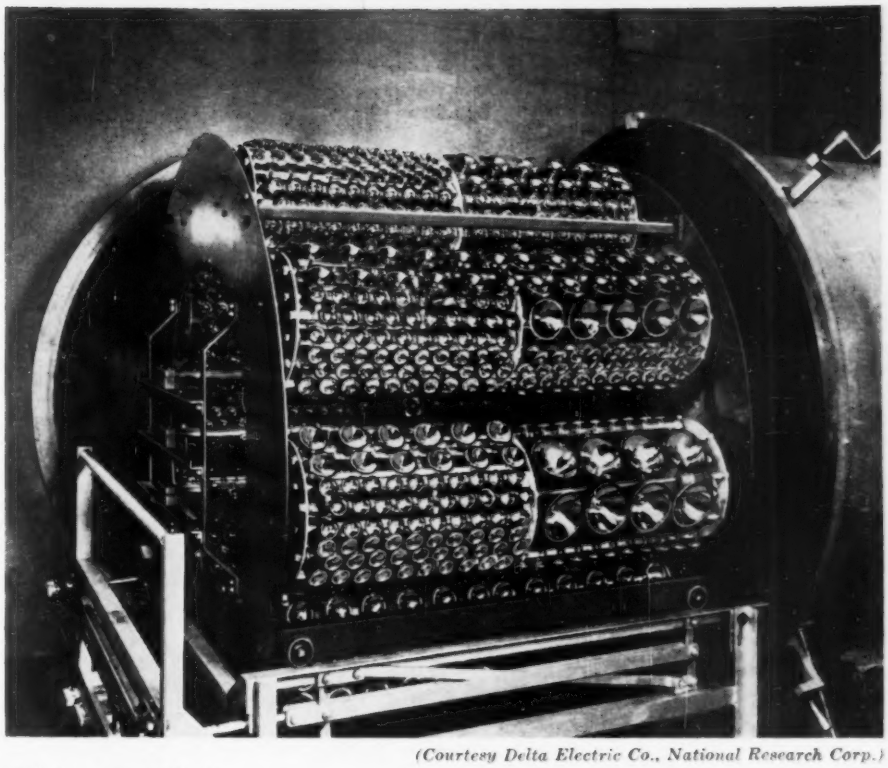


Figure 2. This loaded jig is ready to carry the work mounted on it into the vacuum metalizing cylinder.

(Courtesy Delta Electric Co., National Research Corp.)

with the vacuum in the next step. A secondary, but important, function of the base coat is to seal in any gases occluded on the surface of the piece.

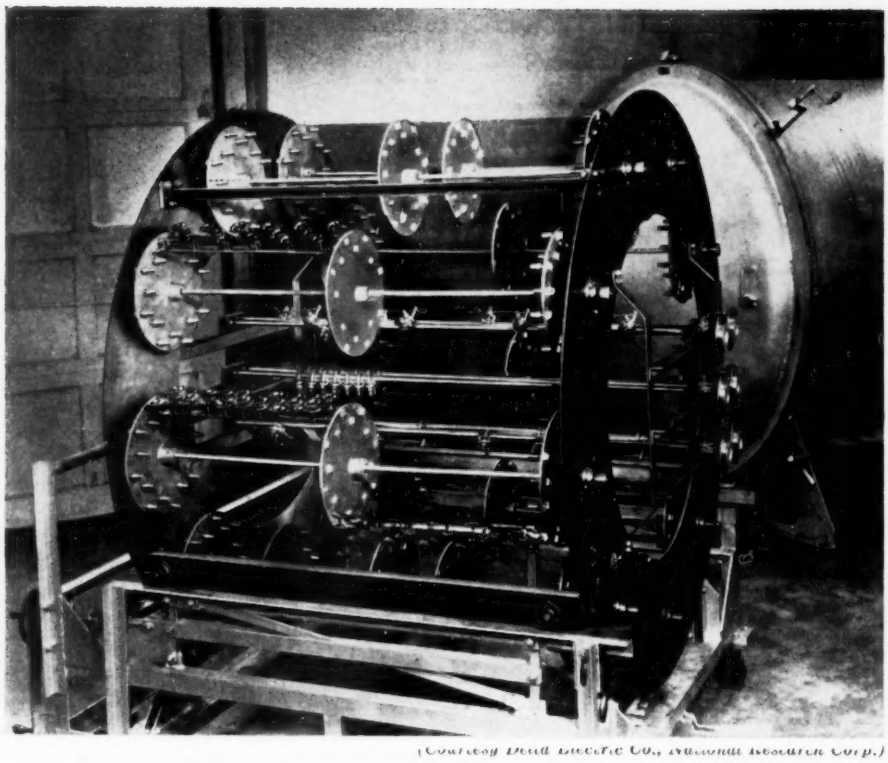
The application of the metallic film to the prepared pieces requires that they be suspended in an extremely high vacuum and that the metal that is to form the coating film be evaporated at high temperature near the center of the vacuum vessel in such a way that the evaporated metal traveling in straight lines will strike all the surfaces to be coated. Although the filament is hot enough to boil aluminum, the work stays at about the temperature of the room. The extraordinary high vacuum is needed to allow the metal to evaporate at temperatures that can be reasonably attained with a hot filament and also to permit the infinitesimally small particles of the evaporated metal (molecules) to travel over the considerable distance necessary to reach the work without in the meantime having been impeded or deflected on the way by hitting molecules of the air filling the space.

It is hard to picture the tremendous numbers of molecules of gases that occupy space. The number of molecules in a single cubic foot of gas at atmospheric pressure and at the freezing point of water is 77 with 22 zeros after it, a number far too huge to imagine. In a mass of air molecules as dense as that, the vaporized molecules of metal in the vacuum metalizer would have very little chance to hit the work without being deflected or stopped by colliding with others. But, if the air is drawn out of the space by a series of high speed vacuum pumps, the density of the air molecules in the space between the evaporating metal and its target can be reduced to a millionth or even a ten-millionth of its orginal value and then a great many metal molecules, freed by evaporation, can hit and stick to the work. That is the essential condition of vacuum metalizing.

Formerly, pumps for producing such a vacuum had low capacities and no one undertook to evacuate any but the smallest volumes, and those only after he had taken the most painstaking care to seal up every leak. But today's workers can employ vacuum diffusion pumps of so much greater capacity than even a dozen years ago, that large volumes, big enough to hold small articles by the thousands, can be readily evacuated to the necessary point within a few minutes. Largely, this increased evacuating capacity comes from the larger size and improved efficiency of modern pumps. Without it the process of vacuum metalizing could only be employed as it was formerly, on high precision work that could bear the high cost of producing vacuum with slower pumps.

The metalizing operation is quite independent of the kind and size of the articles coated. Naturally the capacity of the unit depends upon the number of pieces per charge that can be loaded properly into the chamber. The metal streaming in straight lines from the filaments must be able to reach directly all the surfaces to be coated, since the particles will not go around corners. If the pieces are small and can be arranged on rotating fixtures, a charge may consist of several thousand pieces, whereas larger pieces may be of such shape and size that one or two hundred or less may fill the available space. The amount of metal consumed in the coating is so small as to be negligible in figuring costs. The reason for this is that the coating itself is extremely thin. Decorative electroplates are sometimes only a tenth of a mil thick, but the films common in vacuum metalizing are far thinner, usually only a few thousandths of a mil thick. Furthermore, the preferred metal for vacuum metalizing is aluminum, both because it readily vaporizes under practicable conditions and because the film formed from it possesses high reflectance (85% average) even in the thin layers employed here. And aluminum does not tarnish. Actually the expense for aluminum is less than for tungsten. Although the wire filaments are not consumed in the operation, molten aluminum makes them brittle and inadvertent damage that happens in spite of care on the part of the operator requires replacement of the tungsten wires periodically.

Modern metalizing practice is carried out in large cylindrical coating chambers that may be as much as 5½ feet in diameter by four to six feet long. These cylinders are placed horizontally with one end a full opening door that allows the work to be put in on fixtures that hold the individual pieces. The work is loaded on these fixtures in the beginning and goes through the whole cycle of operations on them. The individual pieces are thus handled only twice, as they are loaded



(Courtesy Pfaff Electric Co., National Research Corp.)

Figure 3. This large round jig carries the work into and out of the vacuum metalizing cylinder and turns the work during the application of the metal to secure uniform coating of pieces.

on and unloaded from the fixtures. The fixtures are provided with jigs that turn the work in the stream of metal particles to insure that all sides are coated with metal.

The necessary diffusion pumps are connected to the chamber and these are backed up by mechanical pumps to increase their efficiency. A series of comparatively heavy tungsten filaments are arranged along the axis of the cylindrical coating chamber and these are connected to an electric power supply that permits them to be heated to high temperatures in a few seconds. On each section of the tungsten wire are hung small pieces of the metal to be used for coating (usually aluminum) in such a way that this wire will be melted and heated to the vaporizing point by the current in the tungsten wires. The fixture containing the work is so arranged that each piece is rotated so that every surface to be coated is exposed directly to the hot wires. The loaded fixture is run into the chamber and the door closed. Then the vacuum pumps are started and quickly evacuate the chamber. As soon as the pressure has been brought to the desired low point (less than one micron of mercury absolute pressure), the filaments are heated to evaporate the metal. The jigs containing the work are turned to expose every surface to the stream of metal vapor pouring from the hot filaments. Then the vacuum in the coating chamber is relieved and the work removed, still on its fixture. The cycle in the metalizing chamber consumes fifteen to thirty minutes, from loading the work into the chamber until it is removed and the chamber is ready for the next charge. The time required to evacuate the chamber, which occupies most of the work cycle, depends basically upon the efficiency of the vacuum system, but it also depends on the condition of the work itself. If the work is dry and free from solvents that would evaporate in the vacuum and, if the relative humidity of the work room is low so that no moisture is adsorbed or condensed on the surface of the work, the time required for reaching the requisite vacuum is materially shorter than when these conditions do not prevail.

The thin metal coating is easily injured and it must be protected by a second organic coating. For this purpose the requirements of the coating material are established by the service expected of the finished objects rather than by any conditions inherent in the process. Thus the finish must wear well and dyes can be introduced into it to change the shade of the bright aluminum to gold or any other color or shade that may be desired. While it is easily possible to apply metals other than aluminum by the same method, the characteristics of this metal lend themselves best to production operations. For that reason aluminum is preferred unless some special service requires the use of another metal. For mirrors to reflect infra red (heat) radiation, gold is preferred and gold and silver are often employed to coat the quartz crystals used in controlling high frequency electronic equipment as a means of making electrical contact and of forming accurate condensers embodying these crystals. Zinc, as well as aluminum, coatings are sometimes applied to paper to form electrical condensers. Techniques for applying metal coatings to paper or cellophane sheet material for decorative uses continuously have been devised and operated.

Vacuum metalizing consumes trifling amounts of metal as we have noted, which makes it particularly attractive now to operators who have no D.O. priorities and, as a result, face difficulty in obtaining strategic metals. Development of an easily available filament material having the desirable characteristic of tungsten is now nearing the stages of completion at NRC.

Costs are difficult to figure without complete specification of the articles to be metalized. With metal parts the whole operation, including the two lacquer coats and the intermediate metal film, usually costs considerably less than electroplating that commonly requires the base metal to be burnished or buffed before plating and the deposit afterward, sometimes with a final protective lacquer coat. Plastics and glass cannot be electroplated directly and hence comparison here must be with the silver reduction method of metal coating that is usually several times as expensive as the vacuum process. As in all such operations involving the handling of many small pieces, labor costs of this part of the process are somewhat uncertain depending upon the class of labor available and the skill of the individual workers.

The process possesses a number of inherent advan-

tages that insure its continually wider application:

(1) Low cost, based on the inherent low cost of the operation itself and the substitution of a low cost organic coating for buffing and burnishing;

(2) Applicable to low cost fabricated metal base parts made by stamping, spinning, die casting, slush casting and other low cost methods;

(3) Applicable to plastics of many kinds fabricated by any of the recognized methods;

(4) Requires familiar production methods in racking parts and applying organic coatings, and introduces no intricate specialized operations in the vacuum stage beyond the ability of an ordinarily intelligent worker;

(5) Involves no special hazard and employs no corrosive liquids or noxious gases that might injure workers or cause complaints from neighbors; and

(6) Effective use of the metal employed for metalizing reduces the amounts required to a low minimum at a time when restrictions limit all uses of metals.

In the early days of vacuum metalizing, the greatest volume of production centered around small plastic objects of various kinds. The reasons for this seem clear. Small objects lent themselves to treatment in the vacuum chambers of limited size that were the best available in the beginnings of this art. With vacuum pumps of small capacity, metalizers were limited to small vacuum chambers and hence to small objects that could be treated in them. The second reason why small plastic objects predominated (and still do) in vacuum metalizing practice is that no other method is available for producing a similar finish on plastic pieces. Thus, the technique could be developed as applied to plastic pieces without serious competition, especially on price.

The equipment and techniques of vacuum metalizing have been developed to the point of opening new important fields. Larger machines having higher efficiencies and improved methods that shorten working cycles are enabling operators to metalize such pieces as radio cabinets and other large objects. In the same way, a metallic finish can be applied cheaply and effectively to die castings that are expensive to finish by electroplating methods because of the difficulty of getting smooth surfaces for plating.

In the field of larger parts, metalizing possesses inherent advantages over older techniques. As we have pointed out, an organic coating smooths the surface of the work cheaply and efficiently at a substantially lower cost than usual polishing methods. This is true of large parts as well as small ones and gives vacuum metalizing a substantial lead over electroplating and over the less successful silver spray plating method.

Finally the extremely high finish attainable with vacuum metalizing on reflectors and mirrors of various kinds has already opened large volume markets for this technique in the lighting field. One of the many applications is finishing mirrors for flashlight reflectors and for sealed-beam automotive headlights, for instance.

Indeed, the only limit to vacuum metalizing finishes for articles of any kind and practically any size appears to be the service life and permanence of the final organic coating that completes the work and protects the thin metal film from damage.

Quick Information on Vacuum Metalizing

What does it do? Produces a bright metal surface on plastics, metal or glass, on big parts or little parts.

Do many people use the process? Capacity of existing installations is estimated at about 4,500 gross per hour of small plastic or metal items.

How does it work? Very simply. Metal films are produced in just the same way as the film of condensed water is formed when a piece of cold glass is held over the spout of a boiling teakettle. Or perhaps the process more nearly resembles the condensed film of moisture formed when you blow your breath on your spectacle lenses.

What can it do for me? I have plastic or metal parts

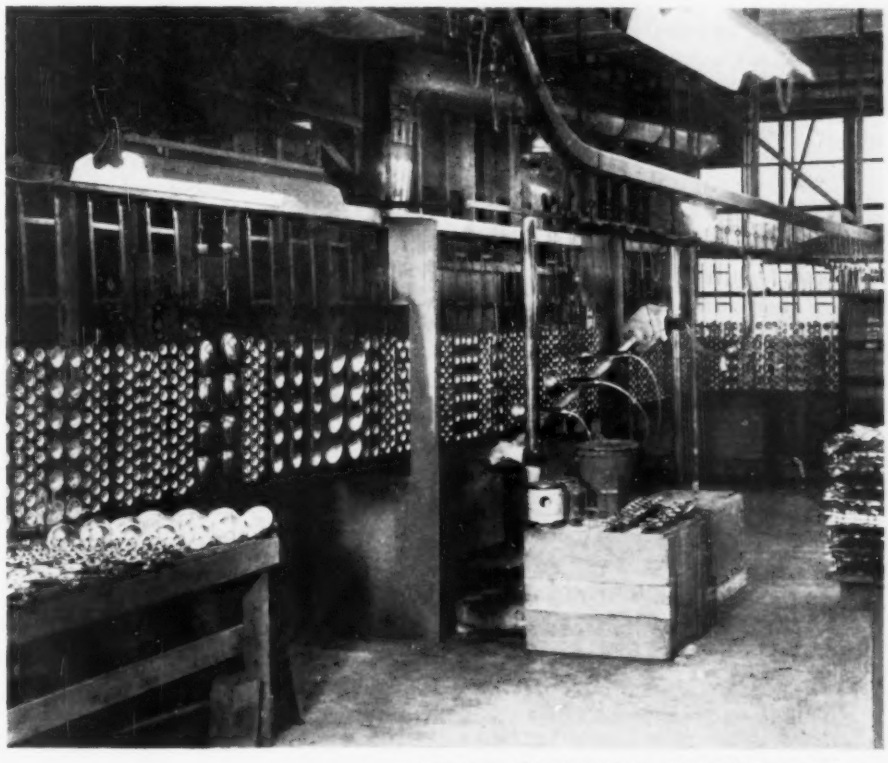


Figure 4. Pieces are prepared for vacuum metalizing by applying a coating of baking enamel to insure a mirror smooth surface to take the metalizing. The system shown here uses an electrostatic charge to direct the spray and is automatic in operation. The automatic conveyor and infra red baking oven are shown.

(Courtesy Delta Electric Co., National Research Corp.)

to finish. Probably one or all of the following things:

1. Eliminate critical materials.
2. Reduce costs.
3. Improve finish quality.
4. Permit substitution of plastic for metal with no change in appearance.

How can I decide if I should use the process? Contact a manufacturer of the equipment. He will gladly coat samples for you at no charge. He will recommend the purchase of suitable equipment or direct you to a competent custom finisher if your production does not justify investing in an installation.

What substances can be deposited?

1. Metals.
   Theoretically — or in the laboratory — any metal can be used. In commercial practice over 99% of all metalizing uses aluminum. Aluminum is easy to handle and produces a non-tarnishing film which simulates bright chromium or silver. It is highly reflective and well suited for tinted overcoats to give it the appearance of gold or to produce iridescent or other colored effects. A small amount of coating is done with silver and gold. A wide variety — but a very small relative volume — of metals are used for optical coatings and similar scientific purposes.
2. Non-metals.
   Non-metals are used for technical or scientific purposes and are of little or no interest to the commercial operator. Magnesium fluoride on glass for low-reflection is the most commonly used non-metal.

What materials are suitable substrata? Three general requirements determine whether materials are suitable for decorative commercial coating:

1. The surface must be smooth and polished to get a highly reflective bright coat; no polishing or buffing is possible after the coating is applied.
2. The surface must be clean.
3. Nothing on or in the surface can evaporate into the high vacuum. Porous materials, or highly plasticized materials, must be sealed with a suitable impermeable organic finish developed for this purpose.

These requirements can be met by all plastics, metals, glass and even porous materials like wood, if suitably handled. Recent advances in sealing finishes permit excellent and economical processing of a wide variety of substrate materials.

Plastics can be coated as they come from the mold provided that they are not plasticized and the molds are highly polished. Escutcheons, automobile horn buttons and similar ornaments are handled this way. However, the majority of finishers find it more economical to provide the polished clean surface by a dip or spray coat of a suitable organic finish. Plasticized materials, like the acetates, require an undercoat to seal in the plasticizer. No other process is in any way competitive with vacuum coating for producing decorative metal finishes on plastics.

Metals usually can be polished and coated directly, but the probable deleterious effect of oxide films on adhesion has not been measured. The principal advantage of vacuum coating metals is the elimination of expensive finishing steps like buffing. An excellent surface is produced directly on a stamping or a die casting by a dip or spray of organic undercoating, a process that allows any base metals to be used. Mild steel can be substituted for more costly and scarcer metals like brass.

What are the characteristics of an evaporated metal film? The films are not quite as dense as massive metal and they can be penetrated by moisture and solvents. They conduct electricity and heat somewhat less efficiently than massive metal. Unless unusual and uneconomical care is taken in surface preparation, they contain large numbers of small pin holes that in no way detract from the appearance and are invisible except under closest examination. Abrasion resistance is more than adequate for process handling, but not for further service. This relative delicacy results from the thinness of the film. Adhesion is good; the film sticks well enough for most applications and this is no problem in commercial decorative coating.

How can the films be protected, and how well? In "back-side" coating, often used for appliance and automotive ornaments, the molded piece itself provides protection against handling and abrasion.

With completely coated pieces that are subject to handling or other abrasion, the metal film must be protected by a suitable organic finish. The limit of useful life is determined by this protective coating. Many suppliers of organic finishes are in close touch with the requirements of the trade, and now offer satisfactory materials for this use. These were closely held trade secrets a few years ago but are now available generally. Recently improved toughness, hardness and durability of these protective finishes extend the potentialities of vacuum coating tremendously. On metal, the high temperature baked finishes are extremely durable. To determine if protection is adequate for a specific application, it is best that samples be prepared and subjected to a service test since blanket statements regarding untried applications may be misleading.

Anodizing Aluminum With Sulfamic Acid

Comparison of Sulfuric, Oxalic and Sulfamic Acid Processes

Sakae Tajima, Yasuyuki Kimura and Toshiro Fukushima,
(Laboratory of Electrochemistry, Tokyo Metropolitan University and Chemistry Division, Metropolitan Industrial Research Institute, Tokyo)

This is the second and final installment of this article. The previous installment was published in our October issue.

—Ed.

Fig. 10 shows the properties of as-anodized and steam-sealed aluminum.

Steam-sealing was carried out in an autoclave at 5 kg./cm.^{2} steam pressure for 35 min. Abrasion resistance and corrosion resistance of as-anodized films were highest at 25°C. After steam-sealing, the abrasion resistance decreased but the corrosion resistance increased remarkably and was at a maximum with the film formed at 43°C. The comparisons are summarized in Table 2.

Table 2. Effect of Steam-Sealing on Properties of Films Formed at Various Bath Temperature with 7.5% HSO_3NH_2, 1 amp./dm.^{2} d.c., 20 min.

Bath Temperature °C:	12	25	35	43	54
Ratio of corrosion resistance after sealing :film as-anodized	3.1	3.0	9.2	12.5	11.4
Ratio of abrasion resistance after sealing :film as-anodized	1.03	0.96	0.97	0.82	0.36

From Table 2, it will be noted that films formed at higher temperature are affected to a greater degree by steam-sealing. The abrasion test employed in our experiments was the combination of slip and impact abrasion, so it is considered that, by steam-sealing, the resistance of the film to impact abrasion decreased and the brittleness increased. Microscopic observation was made of the impression of a diamond cone penetrator on a specimen. On an anodized surface only a clear impression was observed while, on a sealed surface, many cracks were found in the vicinity of the impression. This indicates that the steam-sealed film is very brittle.

The thickness of all films formed at 12-35°C. was the same and at 43 and 54°C., current efficiency calculated by thickness was less than at lower temperature. Affinity for dyes was excellent at higher temperature. The

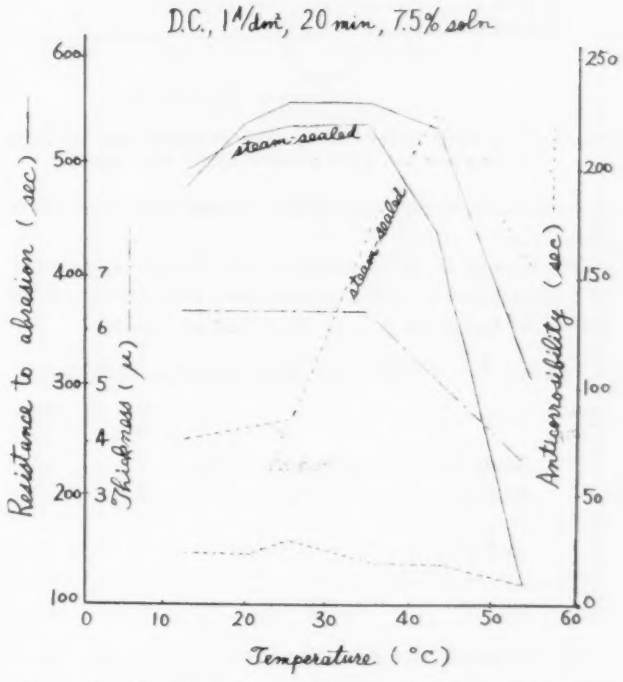


Figure 10. Properties of as-anodized and steam sealed films formed at various temperatures, d.c. 7.5% sulfamic acid, 1 amp./dm.^{2} 20 min.

film formed at 43°C. was dyed by Roccellin Acid and Direct Black to give a satisfactory color. With the film at 54°C. affinity was improved. But absorption of Lionol Blue was scarcely observed even with films formed at high temperature.

As regards the dyed films, those formed at 43 and 54°C. were colorless and those at 12°C. were light brownish-gray (Hue 7, Luminosity 17 and Saturation 1).

(b) Alternating Current Process:

Electrolyte: .5% HSO_3NH_2
Temperature: 10, 20, 35, 45 and 54°C.
Temperature: 10, 20, 35, 45 and 54°C.
Current Density: 1.0 amp./dm.^{2}
Time: 20 min.

Bath voltage variation with time is shown in Fig. 11. At 10 and 20°C., rough and easily removable films were formed and, at the same time, unstable fluctuation was observed. At 35°C., bath voltage increased regularly after the voltage drop at the initial stage of

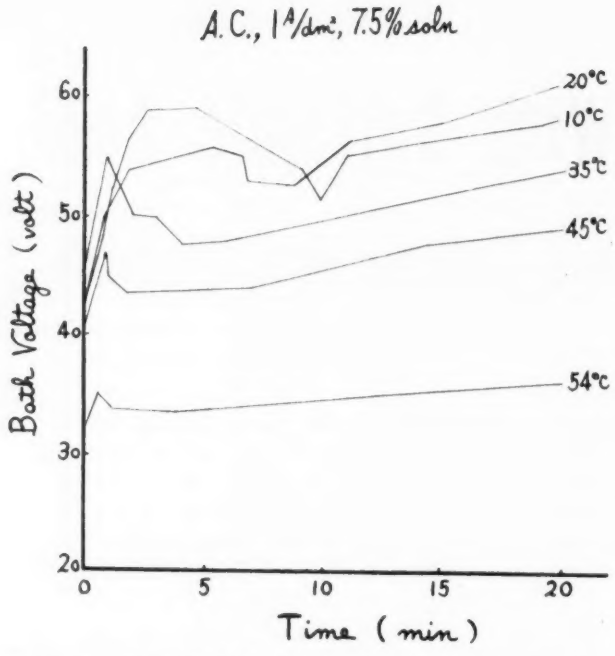


Figure 11. Change in bath voltage with anodizing time at various temperatures, a.c. 7.5% sulfamic acid, 1 amp./dm.^{2}.

formation and the appearance of the film was fairly good.

At 45 and 54°C., smooth green films were formed. It was unusual to get a green color and details of the nature of the color will be described in Table 3.

Table 3. Color of Film Formed with a.c.

Bath Temp.		*Color*	*Saturation*	*Luminosity*
35°C.	As-anodized:	greenish white	1	19
	sealed:	pale turtle green	2	19
45°C.	As-anodized:	willow	3	18
	sealed:	apple green	4	18
54°C.	As-anodized:	willow	4	17
	sealed:	apple green	4	17

Properties of the films are shown in Fig. 12, values

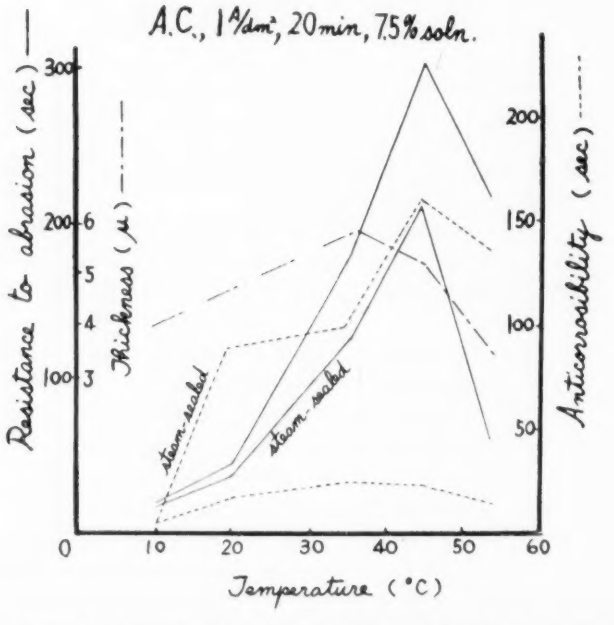


Figure 12. Properties of films anodized at various temperatures, a.c., 7.5% sulfamic acid, 1 amp./dm.^{2} 20 min.

being inferior to those of d.c. process. The effect of steam sealing is similar to the d.c. process, viz. abrasion resistance decreased and corrosion resistance increased. The effects are larger at higher temperature. Affinity for dyes was satisfactory at 45 and 54°C., though the admixture of green color could not be eliminated.

(D) Effect of A.C. Superimposition

Electrolyte: 7.5% HSO_3NH_2
Temperature: 25°C.
Time: 20 min.

Single phase a.c. current was passed between two specimens (0.5 dm.^{2} each) of the same type as were used as anodes in the d.c. process, as shown in Fig. 1. During anodizing, the sum of a.c. and d.c. current density (abbreviated as Da and Dd) was kept constant at 1.0 amp./dm.^{2}. Corresponding bath voltage variations of the a.c. and d.c. processes are shown in Figs. 13 and 14.

By comparison of the values of Figs. 13 and 14 with

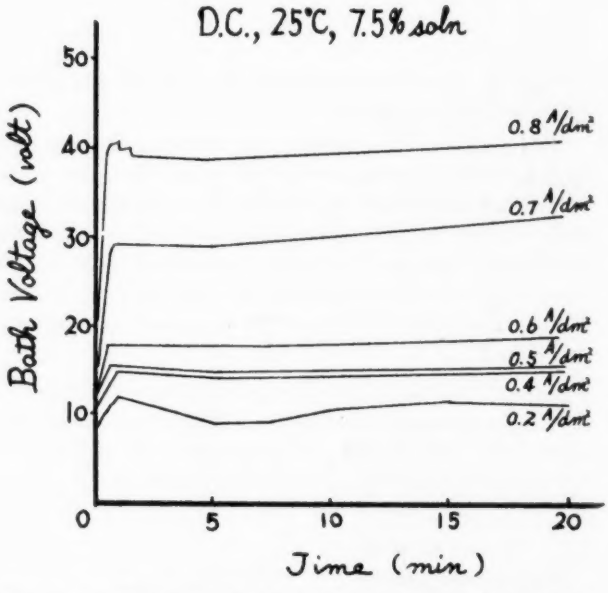


Figure 13. Change in d.c. bath voltage with anodizing time in 7.5% sulfamic acid at 25°C. when d.c. and a.c. are superimposed. Total current density kept at 1 amp./dm.^{2}.

those of corresponding current density of Figs. 5 and 7, it is clear that bath voltage of d.c. and superimposed a.c., were lower than those of d.c. or a.c. alone. Concerning the appearance of the films, small streaks were observed when Da:Dd = 2:8, and they grew larger with increase of Da. When the Da fraction was above the ratio Da:Dd = 1:1, a very rough film like an a.c. film was formed.

Thickness, abrasion resistance and corrosion resistance decreased by superimposition of a.c. as shown in Fig. 15, but corrosion resistance after steam sealing was better at a certain ratio of a.c. superimposition. e.g. Da : Dd = 4 : 6 or 5 : 5. Therefore, the degree of steam-sealing is considered to be dependent upon the porosity of film which results by a.c. superimposition.

In conclusion, the superimposition of a.c. on d.c. was not favorable with sulfamic acid baths at ordinary temperature because of its deleterious influence on abrasion resistance and on appearance of the films.

The superimposition should be applied, if ever, at higher concentration and at higher temperature.

Comparison of Sulfamic, Sulfuric and Oxalic Acid Processes

Comparisons of anodizing conditions and properties of films formed under optimum conditions in the above experiments, sulfamic acid—7.5%, 1.0 amp./dm.^{2} d.c., 25 to 35°C.—were made with those of sulfuric acid (15% vol.) and oxalic acid (2% wt.); anodizing processes which have been applied commercially in Japan.

Comparisons of the change in bath voltages are shown in Fig. 16. The average bath voltage was lowest in the sulfuric acid bath, and oxalic and sulfamic acids followed. The degree of increase in bath voltage after 60 min. anodizing was below 1 volt with sulfuric and oxalic acids but with sulfamic acid, it was above 15 volts. Hence, a denser and more compact film was sup-

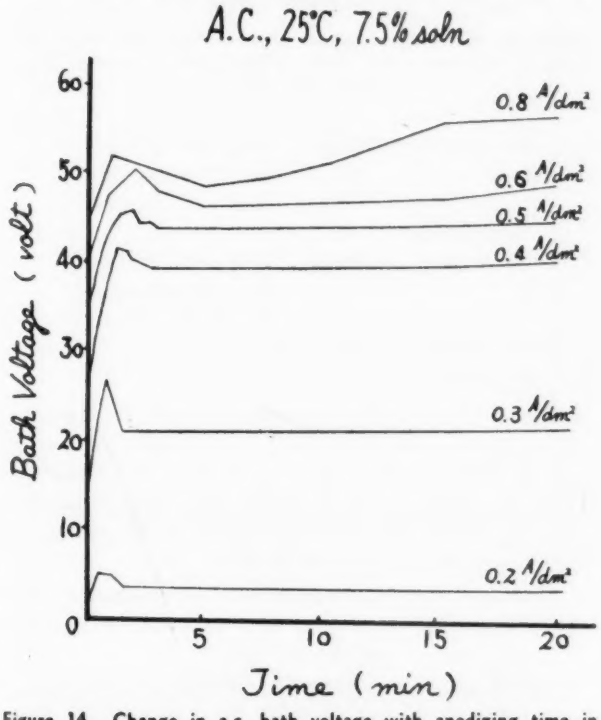


Figure 14. Change in a.c. bath voltage with anodizing time in 7.5% sulfamic acid at 25°C. when d.c. and a.c. were superimposed. Total current density kept at 1 amp./dm.^{2}.

posed to be formed in the sulfamic acid bath. Sulfamic acid films were thickest, after which sulfuric and oxalic acid films followed as shown in Fig. 1. The sulfamic acid films ranged from 82 to 96% of the theoretical thickness.

Abrasion resistance was highest with the sulfamic acid film, as shown in Fig. 18. It is clear that the film possess the highest resistance to impact abrasion. The abrasion resistance of sulfuric acid films compared with sulfamic acid films at the initial stage of anodizing, but gradually decreased to a value lower than that of oxalic acid films. Sulfuric acid films were remarkably affected by steam-sealing and the abrasion resistance dropped to 25 to 43% of as-anodized films. The abrasion resistance after sealing of oxalic acid films decreased to 33 to 77% and sulfamic acid films to 74% with 5 min. anodizing periods and 93 to 113% with anodizing periods over 10 min.

Corrosion resistance of as-anodized films is shown in Fig. 19. Sulfamic films were highest and oxalic and

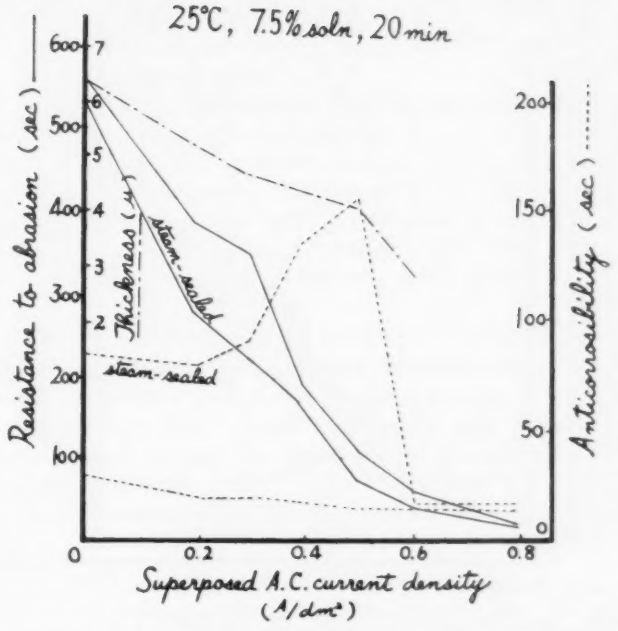


Figure 15. Properties of films anodized by superimposition of d.c. and a.c. in 7.5% sulfamic acid, 20 min., 25°C. Total current density kept at 1 amp./dm.^{2}.

sulfuric acid films followed. Steam-sealing was very much effective on oxalic acid films and extremely good corrosion resistance was obtained. Sulfamic acid films were also affected by steam-sealing. Corrosion resistance of sealed sulfamic acid films was higher than that of sealed sulfuric acid films but the sealing effect was smaller than for the latter.

Required anodizing time to get enough adsorption of dyes was as follows.

Sulfuric acid bath:	30 min. (for Lionol Blue 45 min.)
Oxalic acid bath:	45 min. (for Lionol Blue 60 min.)
Sulfamic acid bath:	60 min. (for Lionol Blue unfavorable)

As the 60 minute-anodized sulfamic acid film was of brownish gray color (Hue 7, Luminosity 16, Saturation

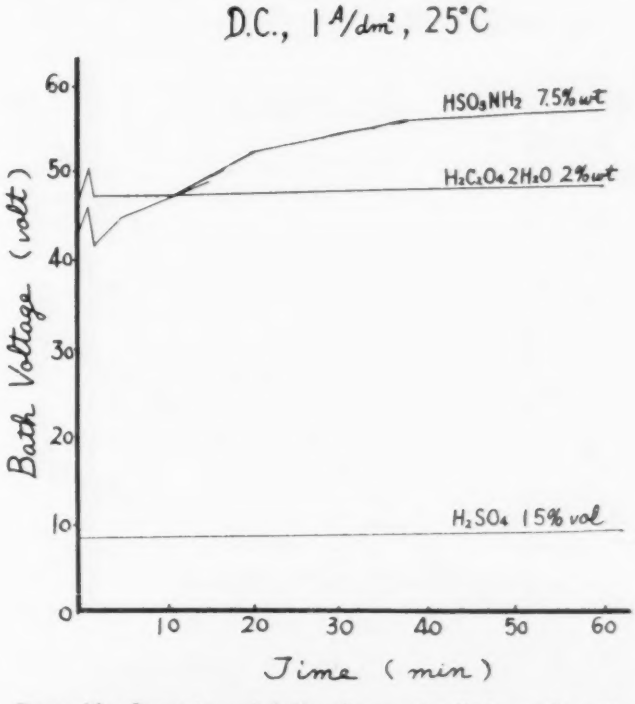


Figure 16. Comparison of bath voltages of sulfuric, oxalic and sulfamic acid anodizing, d.c., 1 amp./dm.^{2}, 25°C.

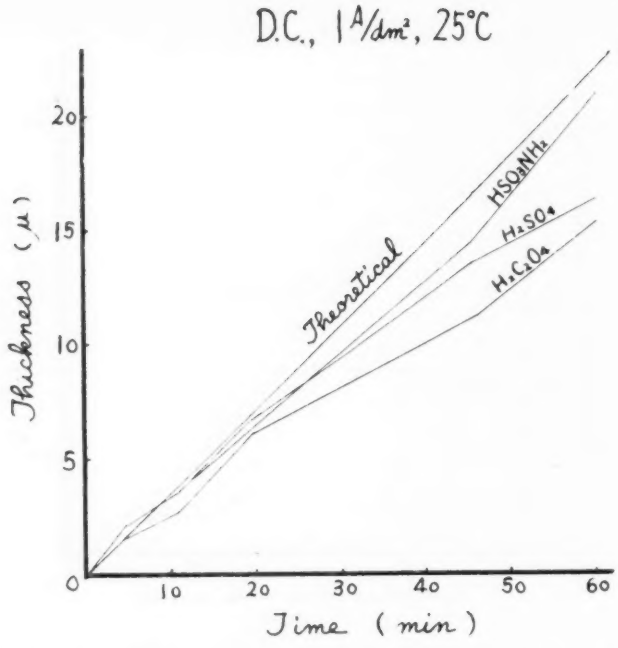


Figure 17. Thickness of films anodized in sulfuric, oxalic and sulfamic acid baths, d.c. 1 amp./dm.², 25°C.

1), it was not favorably dyed by dyes of certain colors, while dyed sulfuric and oxalic acid films were pale yellow (Hue 8, Luminosity 19, Saturation 2), and difficulties in dyeing were encountered.

Two Step Anodizing with Sulfuric (a.c.) and Sulfamic (d.c.) Acids

For anodizing with sulfamic acid, it is recommended to raise the bath temperature or to superimpose a.c. in order to secure sufficient affinity for dyes, but this is unfavorable from the viewpoint of abrasion resistance, corrosion resistance and plant facilities.

Therefore, two step formation was attempted in the following manner:

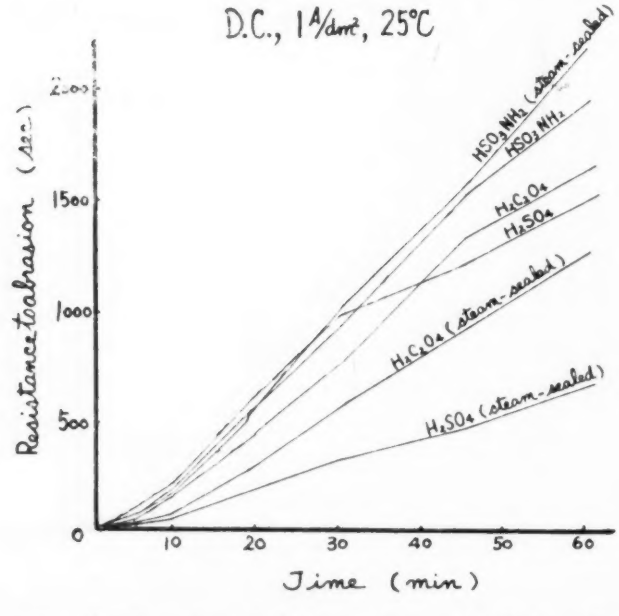


Figure 18. Comparison of abrasion resistance of sulfuric, oxalic and sulfamic acid films.

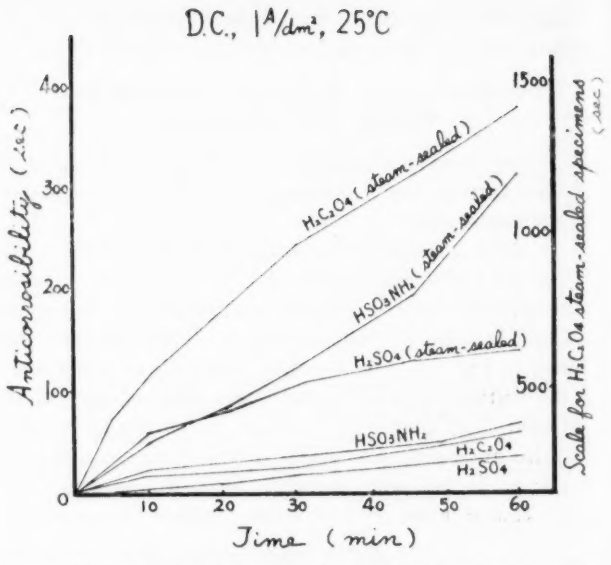


Figure 19. Corrosion resistance of as-anodized and steam sealed films by sulfuric, oxalic and sulfamic acid processes, d.c., 1 amp./dm.², 25°C.

1. Primary anodizing	15% vol. H_2SO_4 a.c. 1.0 amp./dm.² 5, 10, 15, 20 min.
2. Water rinse	
3. Secondary anodizing	7.5% wt. HSO_3NH_2 d.c. 1.0 amp./dm.² 25 ,20, 15, 10 min.

Total anodizing time 30 min.
Temperature 25°C.

The samples anodized 5 min. in the H_2SO_4 bath and 25 min. in the HSO_3NH_2 bath, were dyed to a reddish-orange color by Roccellin Acid solution. Films produced in 10-20 min. showed very good affinity for dyes, certainly better than films produced by 30 min. a.c. in H_2SO_4 and 30 min. d.c. in H_2SO_4.

Abrasion resistance and corrosion resistance of as-

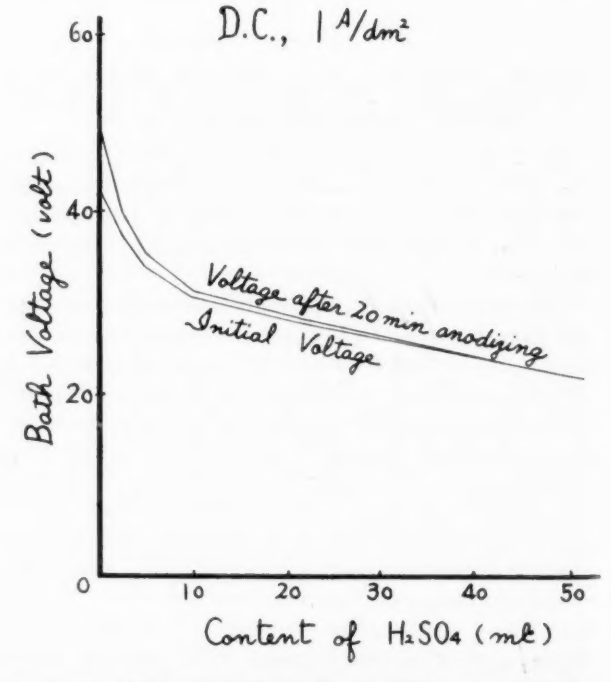


Figure 20. Effect on bath voltage of sulfuric acid addition to sulfamic acid bath.

anodized and steam-sealed films are shown in Table 4.

Table 4. 2 Step Anodizing in Sulfuric and Sulfamic Acid and Comparison with Straight Films (at 25°C.)

Anodizing time (min.)		Corrosion resistance (sec.)		Abrasion resistance (sec.)	
H_2SO_4 15% vol. a.c. 1 amp./dm.²	HSO_3NH_2 7.5% wt. d.c. 1 amp./dm.²	As-anodized	Sealed	As-anodized	Sealed
30	0	6	50	325	143
5	25	22	60	780	670
10	20	17	42	640	540
20	10	18	50	500	305
0	30	37	126	955	994

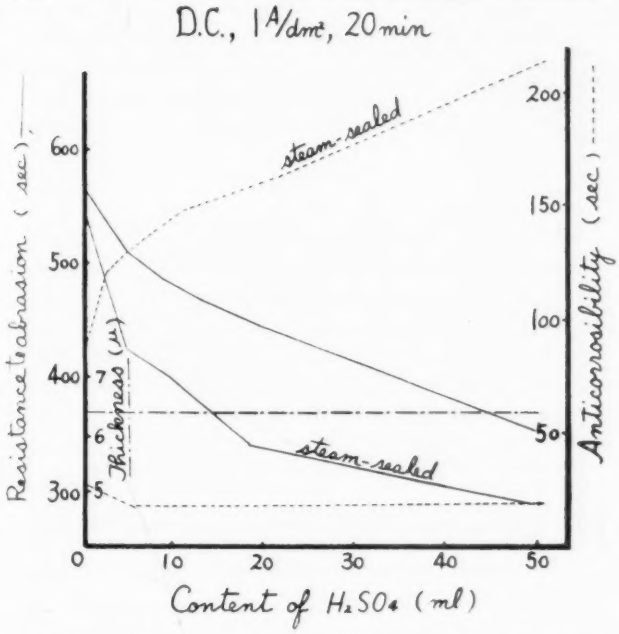


Figure 21. Properties of films anodized in sulfamic acid with sulfuric acid addition.

For steam-sealed films, abrasion resistance was more excellent than that of sulfuric acid films (d.c), and corrosion resistance was rather equal to that of sulfuric acid films (a.c.).

Therefore, in conclusion, the better affinity for dyes was obtained at room temperature by means of the 2 step process. Abrasion resistance was also better. Corrosion resistance was not so much improved but was not at all unfavorable for practical use. At any rate, it is to be borne in mind that the rapid rise of bath voltage at the start of secondary anodizing in sulfamic bath should be avoided because of the local dissolution of anode.

Effect of Sulfuric Acid Addition to Sulfamic Bath

Anodizing conditions and variations of properties of anodized films were studied with the mixed electrolyte of sulfamic and sulfuric acids. 2162.2 g. of 7.5% sulfamic acid solution (162.2 g. of sulfamic acid dissolved in 2 L. of distilled water) were prepared as main electrolyte and sulfuric acid (sp. gr. 1.84) was added in the amount of 0.0, 2.5, 5.0, 10.0, 20.0 and 50.0 ml.

Temperature: 25°C.
Current density: 1.0 amp./dm.²
Time: 20 min.

From Fig. 20, it is obvious that the bath voltage is lowered by about 12% by addition of 2.5 ml. of sulfuric acid, and was gradually lowered as the sulfuric acid content increased. The rise in bath voltage was also diminished by the addition of sulfuric acid and took a similar form as was the case with anodizing with sulfuric acid. Properties of the films are shown in Fig. 21.

Thickness was not affected by sulfuric acid addition. Abrasion resistance and corrosion resistance were lowered and affected remarkably by steam-sealing.

Affinity for dyes was not satisfactory after 20 min. anodizing. Films became colorless with the addition of sulfuric acid to the bath.

It is concluded, therefore, that films formed with the mixed bath of sulfuric and sulfamic acids gives the combined properties of each film.

Summary

A. Anodizing 99.0% aluminum sheet with sulfamic acid and properties of the films were studied.
   1. Formation by d.c. at 1.0 amp./dm.² was very favorable with concentrations of the acid above 7.5% at 25°C.
   2. Optimum d.c. current density to secure good abrasion resistance and corrosion resistance was 1.0 amp./dm.² with the 7.5% bath at 25°C.
   3. Formation by a.c. was very unfavorable and very rough films were obtained with any current density and any concentration of the acid at 25°C.
   4. Suitable bath temperature was from 25 to 35°C. and the effect of steam sealing was excellent with the film formation at 35°C., using the 7.5% acid bath, d.c. current density, 1.0 amp./dm.² and the affinity for dyes was greater for films produced at higher bath temperature.
   5. To apply a.c. current, the bath temperature should be kept over 35°C. with the 7.5% solution, a.c. current density, 1.0 amp./dm.², but the thickness, abrasion resistance and corrosion resistance of a.c. films were inferior to those of d.c. films. Affinity for dyes increased at higher temperature.
   6. The d.c. film became nearly colorless with higher bath temperature and concentration. With higher bath temperature, greenish color was obtained during a.c. formation.
   7. The superimposition of a.c. on d.c. was quite unfavorable for abrasion resistance and appearance of the film at 25°C. Corrosion resistance after steam-sealing is maximum when the ratio of superimposition Da:Dd = 1:1.

B. Comparison of films formed with sulfuric, sulfamic and oxalic acid baths at 25°C., d.c. 1.0 amp./dm.², 20 min. are as follows:
   1. During the initial stage of anodizing, bath voltage was higher in the order: oxalic, sulfamic and sulfuric acid baths. The degree of increase of bath voltage was peculiarly high with the sulfamic acid bath.

(*Concluded on page 74*)

The Electrochemical Society Holds 102nd Meeting

MONTREAL was the scene of the 102nd meeting of *The Electrochemical Society*, from October 26 to 30. A highlight of the meeting was the conferring of an Honorary Membership in the Society on *Dr. William Blum* at the general luncheon. *George B. Hogaboom* spoke about Dr. Blum and his accomplishments.

The *Electrodeposition Division* of the Society held sessions on all three of the technical meeting days and a number of papers were presented which would be of interest to *Metal Finishing* readers. These are abstracted below.

ABSTRACTS OF PAPERS PRESENTED AT THE SESSIONS ON ELECTRODEPOSITION

Electrodeposition of Copper from the Monoethanolamine Bath

T. L. Rama Char and N. B. Shivaraman

Copper has been electrodeposited on steel by using a complex copper-monoethanolamine solution. This does not deposit copper on steel by immersion. The deposits are smooth, fine-grained, bright and adherent, and the bath is comparable to the cyanide bath. The inclusion of Rochelle salt considerably improves its performance. The optimum conditions are: copper oxalate 60 g./l., monoethanolamine 60 ml./l. Rochelle salt 60 g./l., 2.4 to 4.8 amp./dm.^{2} (22.3 to 44.6 amp./ft.^{2}), 2.9 to 4.3 volts, pH 9.5, and 24°C. The addition of nitrates has some beneficial effect.

Studies of the Mechanism of Bright Plating in the Acid Copper Bath*

Bacon Ke and Dan Trivich

In the acid copper bath, polarography shows that thiourea suppresses the maximum and shifts $E_{1/2}$ for copper to more negative potentials, while dextrin lowers the diffusion current, the effects of the two being additive.

On Cu single crystals, the bath without brighteners gives bright, single crystal deposits on 111 faces and polycrystalline, matte deposits elsewhere. With brighteners, the deposits are polycrystalline and bright all over. Thiourea with C^{35} shows no localized adsorption on Cu single crystals.

*Sponsored by Office of Ordnance Research, U. S. Army.

The Electrodeposition of Copper and Nickel*

John Yeager, Ernest Yeager, and Frank Hovorka

Polarization and structural measurements have been made for copper and nickel as typical metals with low and high-polarization. A stream of electrolyte has been directed past the electrode to minimize concentration polarization. The build-up and decay of the polarization following the initiation and interruption of the current have also been determined. The results are interpreted theoretically.

*Research partially supported by the Harshaw Chemical Company through a fellowship to John Yeager.

The Effect of Ultrasonic Waves on the Electrodeposition of Copper*

W. R. Wolfe, Hyman Chessin, Ernest Yeager, and Frank Hovorka

The effects of ultrasonic waves on the electrodeposition of copper have been determined at frequencies of 200 and 1000 kc./sec. with acid plating baths of various concentrations. Polarization measurements have been made by the direct method, while structural information concerning the deposits has been obtained through x-ray and photomicrographic studies. The polarization data is compared with similar data obtained with mechanical agitation.

*Research supported by the Office of Naval Research under Contract No. N7 our 47002, Project No. NR 051 162.

A New Approach to the Investigation of Addition Agents

B. I. Parsons and C. A. Winkler

The system under investigation is a copper-sulfate-sulfuric acid bath with gelatin as an addition agent. Changes in cathode polarization in a Haring Cell are determined with a cathode ray oscillograph. If no addition agent is present the polarization rises almost instantaneously to 100 mv. after the current is switched on, then slowly increases to 110 mv. However, when gelatin is present in the electrolyte the polarization rises to about 250 mv. within five seconds, falls to 200 mv. during the next ten seconds of deposition, then slowly increases to the steady state polarization characteristic of the gelatin concentration. The pattern of the potential-time curve depends on the length of time the cathode is in contact with the electrolyte before deposition is begun, and on other variables under investigation such as concentration and molecular weight of addition agent, age of solution, current density, nature of the cathode surface, stirring, and temperature.

Cathode Polarization Potential During Electrodeposition of Copper

III. Effect of the Cathode Base upon the Cathode Polarization Potential and the Crystal Structure of the Deposit

L. L. Shreir and J. W. Smith

The variation of the cathode polarization with time during electrolysis at various current densities, and with cathode bases of different structures, has been studied. The effects of cold-rolled and annealed foil cathodes, showing preferred orientation and random orientation, respectively, have been compared, and measurements have also been made using ectrodeposited "constant state polarization" bases produced under standard conditions, and electrodeposited bases of coarse and fine structure. The deposits formed under some of these conditions have been studied by x-ray methods. The results support the view of Blum and Rawdon that the cathode polarization is related to crystal size and a change from a coarse to a fine structure is accompanied by an increase in polarization potential.

The Mechanism of Surface Leveling by Periodic Reverse Current Cyanide Copper Plating

Dennis R. Turner

Surface leveling obtained with periodic reverse current cyanide copper plating is attributed to the rectifying properties of a stoichiometric cuprous oxide barrier layer formed during the anodic part of the cycle. Anodic dissolution occurs by means of cuprous ions diffusing through breakdowns in the barrier layer. Breakdowns are more frequent at projected surface areas. The greater rate of anode dissolution at these points produces a leveling action. Experimental evidence is presented which supports the proposed mechanism of leveling.

The Mechanism of Electropolishing of Copper in Phosphoric Acid Solutions

I. Electrical Conditions Associated with Electropolishing

J. Edwards

A preliminary investigation is described of the current-voltage-time relationships recorded by a cathode-ray oscillograph mainly for copper in phosphoric acid solutions. The curves show that a sharp fall in current and rise in voltage occurs when polishing conditions are established and that limiting current conditions exist in the polishing range, as reported by other workers. The dependence of characteristic current oscillations on experimental conditions has been investigated.

The Mechanism of Electropolishing of Copper in Phosphoric Acid Solutions

II. Processes Preceding the Establishment of Polishing Conditions

J. Edwards

An equation by Elmore relating the time required to establish polishing conditions to the current applied has been tested with a copper anode in phosphoric acid. The dependence of a constant in Elmore's equation on anode area, phosphoric acid concentration, copper solubility, viscosity, and copper concentration has been investigated. The results show that the process is diffusion-controlled but that Elmore's hypothesis that the onset of polishing coincides with the attainment of the solubility limit of copper in the electrolyte is incorrect, since additions of copper to the electrolyte were found to have no effect on the constant, except insofar as they modified the viscosity. Two possible explanations of these results are advanced based on the view that the controlling process is depletion of the anode layer with respect to either hydrogen ions or to those ions or molecules with which the copper ions are combined in the solution. It is shown how the latter interpretation can explain the principal features of electropolishing.

The Mechanism of Electropolishing of Copper in Phosphoric Acid Solutions

III. The Mechanism of Smoothing

J. Edwards

Experiments with a composite anode having projections and recesses on its surface insulated from each other showed that the current distribution between projections and recesses underwent very little change when the total current fell and polishing conditions were established. This called for a radical revision of previous views of electropolishing and prompted a quantitative investigation of the smoothing efficiency under different conditions on a surface of standard roughness. The observed efficiencies were compared with those calculated for a wholly diffusion-controlled distribution of attack (identical with primary current distribution) and for equal dissolution at all points on the surface. The conclusion reached is that the mode of smoothing in electrolytic (and chem-

ical) polishing is not specific to these processes but results solely from the variations in concentration gradient within the diffusion layer set up on the anode surface. For any surface of known shape there is therefore a maximum possible smoothing efficiency.

Electronic Configuration in Electrodeposition from Aqueous Solutions

I. The Effect of Ionic Structure

Ernest H. Lyons, Jr.

In aqueous solutions, electrodepositions occurs from ions represented by electronic configurations having hybridized orbitals from the outer electron shell. When the hybridization involves orbitals of the two outer shells, hydrogen rather than the metal is discharged. By comparison with rate studies and mechanisms of the substitution reactions of complex ions, it is inferred that the critical step in electrodeposition is the dissociation of one of the coordinated groups from the metal ion. The theory is discussed in relation to various phases of electrodeposition.

Factors Affecting the Transformation of White to Gray Tin at Low Temepratures

R. R. Rogers and J. F. Fydell

The tendency for white tin, in the form of coatings and otherwise, to be transformed into gray tin is affected by the composition and thickness of the tin, the temperature at which transformation takes place, and the history of the tin prior to the transformation. Gray tin will appear spontaneously under certain conditions, and after inoculation with gray tin or germanium under other conditions. There should be little difficulty in preventing the formation of gray tin if certain precautions are taken.

Electrodeposition of Selenium

R. Scott Modjeska, B. F. Freeberg, and Kurt E. Schimkus

Investigation into methods for producing continuous, dense coatings of selenium is described. The report covers work in both aqueous and nonaqueous electrolytes. Results from cold aqueous solutions were amorphous red selenium, whereas, deposits from hot (80°C.) solutions produced mixtures of black and red sooty deposits. As bath temperature approached the melting point of selenium, deposit tended more toward the metallic phase. Nonaqueous investigations included deposition from baths of alcohol, glycerine, and glycols. The final work was done in solutions of phosphoric acid, effectively water-free, using auxiliary anode chambers.

Electrodeposition of Silver from the Iodide Bath

T. L. Rama Char and R. Sadagopachari

Silver has been electrodeposited on copper from a complex iodide solution. The deposits are white, dense, and adherent, and the bath is comparable to the cyanide bath (without brightener) in respect to quality of deposit, electrode efficiency, current density, and throwing power. The optimum conditions are: silver 20 to 40 g./l., iodide 400 to 600 g./., 0.2 to 1.(amp./dm.^{2} (1.9 to 14.9 amp./ft.^{2}), 0.1 to 0.3 volts and 26°C. Ammonium sulfamate and sodium thiosulfate as additions give semibright deposits.

Some Properties of Stannous Sulfate Solutions and Their Role in Electrodeposition of Tin

II. Solutions with Stannous Sulfate and Sulfuric Acid Present

C. A. Discher

Density, refractive index, surface tension, viscosity freezing-point depression, conductivity, transference number, electrode potential to pure tin and hydrogen, respectively, have been measured for a range of stannous sulfate-sulfuric acid solutions. The effects of the sulfuric acid on these properties are discussed. Relationships between concentration and magnitude of properties and various derived properties are determined. Possible structural species existing in the solutions are suggested.

Electrodeposition of Cadmium from Fluoborate Solutions

T. R. Anantharaman and J. Balachandra

The optimum conditions for electroplating cadmium from its fluoborate solution have been arrived at by a systematic study of the effects of all types of variables on its plating characteristics. The best deposits of cadmium are obtained from a bath containing 210 g./l. of cadmium fluoborate, 25 g./l. of sodium fluoborate, 25 g./l. of boric acid, and 1.0 g./l. of sodium-β-naphthalene sulfonate at a pH of 3.2-3.6, temperatures of 20°-30°C., and at current densities of 20-60 amp./ft.^{2} (2.2-6.5 amp./dm.^{2}). The deposits which are obtained on steel, brass, or copper are uniform, bright, fine-grained, adherent, and of pleasing appearance. The current efficiency of the process is 98-100 per cent cathodic and 102-104 per cent anodic. The bath is non-poisonous, stable, and easily controlled. The new bath is slightly inferior to the cadmium cyanide bath in throwing power and resistivity, but vastly superior to it in all other respects.

Electrogalvanizing from Fluoborate Solutions

T. R. Anantharaman and J. Balachandra

The optimum conditions for electroplating zinc from its fluoborate solution have been deduced by a systematic study of the effects of all types of variables on its plating characteristics. The best deposits of zinc are obtained from a bath containing 180 g./l. of zinc fluoborate, 30 g./l. of ammonium fluoborate, 25 g./l. of boric acid, and 1.0 g./l. of β-naphthol at a pH of 5.0 to 5.4 and temperatures of 20°-30°C., and at current densities of 40 to 90 amp./ft.^{2} (4.3 to 9.7 amp./dm.^{2}). The deposits which are obtained on steel, brass, or copper are uniform, fine-grained, adherent, and of pleasing appearance. The current efficiency of the process works out at 98-100 per cent cathodic and 102-105 per cent anodic. The bath is nonpoisonous, stable, and easily controlled. The new bath is com-

parable to the zinc-cyanide bath and vastly superior to the zinc sulfate bath.

Cathodic Lead Disintegration and Hydride Formation

Hugh W. Salzberg

Lead cathodes disintegrate into colloidal lead at high current densities in alkaline and weakly acid solutions of varying pH and salt concentration at different temperatures, and current densities.

It is concluded that the cause of this phenomenon is the formation and subsequent decomposition of a volatile unstable hydride of lead. The formula of this hydride is PbH_2. It is quantitatively formed at current densities above 10-50 ma./cm.^{2}, depending on the other parameters.

The equation for formulas of PbH_2 is considered to be:

$$e + Pb(H) + H_2O \rightarrow PbH_2 + OH^-.$$

The implications of this on the subject of hydrogen overvoltage are discussed.

The Caustic Electrolytic Zinc Process

Charles T. Baroch, R. V. Hilliard, and R. S. Lang

Zinc is extracted from oxidized ores with NaOH solution, and the zincate electrolyte is purified with zinc powder and lime. The zinc is recovered electrolytically as "flake" powder consisting of pinnate crystals. At 12.9 amp./dm.^{2} (120 amp./ft.^{2}) about 1.5 kwhr./lb. of zinc is required. Many types of oxidized ores have been tested in the laboratory and some pilot-plant work has been done, and the process appears to be feasible.

Development of a Canadian Source of Indium Metal

J. R. Mills, B. G. Hunt, and G. H. Turner

The development of a process for the recovery of indium by the Consolidated Mining and Smelting Company of Canada at Trail, B. C., is described. Indium enters the operations in zinc concentrates. Residues from the electrolytic zinc plant are passed through the lead smelter for recovery of zinc values, and the contained indium accumulates in the lead dross, which is treated to produce a bullion containing lead, tin, indium, and antimony.

This bullion is treated electrolytically by a modification of the Betts Process to yield a lead-tin alloy cathode and a high-indium (30-35%) anode slime. The anode slime is treated chemically to give a crude (99%) indium metal, which is refined electrolytically.

The properties and uses of indium are discussed.

The Electrorefining of Tin

H. G. Poole, G. C. Ware, and F. Block

An electrorefining process has been developed to treat tin scrap having a high copper content. The conventional thiosulfate bath was used. The use of expensive thiosulfate and tin chloride was avoided by preparing the bath with caustic soda, salt, and sulfur. A plant to produce 1000 pounds of refined tin a day has been built and operated successfully for a period of ten months.

A Method for Introducing and Controlling the Concentration of Inorganic Addition Agents

G. R. Van Houten and L. E. Stout

Alloying the addition element with some insoluble anode material produces an anode which corrodes very slowly, liberating the additive. Rate of liberation in a given solution is primarily a function of its concentration in the anode and the anode current density. An example of successful application is the addition of very small amounts of selenium or tellurium to lead and the use of these selenium-lead or tellurium-lead anodes in acid zinc-sulfate electrolyte for the production of bright zinc.

Refining Antimony by Electrodeposition and by Vaporization

R. R. Rogers and R. A. Campbell

Antimony was refined on a fairly large laboratory scale, (*a*) by electrodeposition from a chloride bath using a rotating cathode, (*b*) by vaporization and condensation, and (*c*) by a combination of these two methods. Each method had certain advantages. The one to be chosen in any particular case would be determined by the nature and amount of the impurities in the crude antimony and by the nature and amount of the impurities permissible in the refined material.

Anodic Deposition Behavior of Manganese and Silver

John T. Byrne and L. B. Rogers

The deposition of manganese as the dioxide has been studied both polarographically and by measurements of the equilibrium at a number of different potentials. The studies were carried out over a wide range of concentrations of manganese and it was found that solutions more dilute than $10^{-7}M$ did not precipitate to an appreciable extent on a platinum electrode. By adding lead (II) to the solution lead dioxide was formed which acted as a carrier. In this way complete deposition of the manganese could be effected. Experiments with extremely dilute solutions of silver have shown that silver, although not deposited by itself on the anode, will co-deposit easily with lead dioxide in the same way as manganese.

The Complete Electrodeposition of Radioruthenium

J. C. Griess, Jr.

A study was made to determine the conditions necessary for the complete ($> 99\%$) electrodeposition of radioruthenium. Bright adherent deposits usable as radioactive sources for radiation therapy were obtained from acid solutions containing moderately low concentrations ($5 \times 10^{-4}M$) of ruthenium nitroso salts. The effect of some variables on the rate and completness of plating are given.

A Study of the Electrodeposition of Ruthenium from Very Dilute Solutions

M. H. Lietzke and J. C. Griess, Jr.

The deposition behavior of ruthenium at low concentrations has been investigated under a variety of conditions. Only when the ruthenium was in solution

as the ruthenium nitroso complex were reproducible results obtained. Complete deposition was not possible at concentrations below 10^{-5} molar. A mechanism involving hydrogen reduction of the ruthenium nitroso complex is proposed.

Electroplating on Zirconium

W. S. Schickner, John G. Beach, and Charles L. Faust

Methods are described for producing adherent electroplates on zirconium. As-plated adhesion (about 6000 psi) is obtained by prescribed etching of the zirconium surface prior to plating. Prebaking and heat treatment of nickel- or iron-plated zirconium produces alloy bonds of about 50,000 psi (as indicated by modulus of rupture). Other metals are electroplated over diffusion-bonded nickel or iron plate.

Electroplating on Beryllium*

John G. Beach and Charles L. Faust

Two methods for electroplating on beryllium are discussed: one method involves electrochemical and chemical activation of the beryllium for direct plating with other metals, and the other involves an intermediate replacement zinc film on the beryllium surface. Chemical polishing of beryllium is described. Alloying of the beryllium with the deposited metals and the effect on adhesion are also discussed.

*Based on work performed under AEC Contract No. 7405-eng-92.

Electroplating on Titanium

William H. Colner, Morris Feinleib, and John N. Reding

Titanium is a very active metal which is normally covered with a stable and adherent oxide; it is even more difficult to plate than aluminum and magnesium. Conventional methods of preparing metals for plating (pickling, zinc immersion, etc.) will not yield adherent electroplates on titanium. Good adhesion has been obtained by subjecting titanium to an anodic etch in an essentially nonaqueous bath, based on HF and ethylene glycol. Operating conditions and variables are discussed.

Formation of Immersion Zinc Coatings on Aluminum

W. G. Zelley

The manner in which immersion zinc coatings form on aluminum is described and the importance of such factors as composition of the zincate solution, operating conditions, and effect of surface preparation on the formation of the zinc layer is demonstrated. Several new modifications of the commonly used zinc immersion treatment are described. Finally, the manner in which the immersion zinc layer influences the performance of electroplated aluminum samples is considered and typical performance data are presented.

ANODIZING ALUMINUM WITH SULFAMIC ACID

(*Concluded from page* 69)

2. Thicknesses of films were nearly equal with sulfamic and sulfuric acid under 30 min. anodizing. But over 45 min., sulfamic acid films were thicker and showed an approximately linear increase. Oxalic acid films were thinnest.
3. Abrasion resistance was found to be highest with sulfamic acid films and oxalic and sulfuric acid films followed. After steam sealing, that of sulfuric acid films remarkably decreased but sulfamic acid films did not show notable change, while in some cases it increased slightly.
4. Corrosion resistance was higher in the order: sulfamic, oxalic and sulfuric acid films. Extremely good values were obtained with oxalic acid films after steam sealing.
5. The affinity for dyes was better in the order: sulfuric, oxalic and sulfamic acid films.
6. Color of films anodized for 60 min. by d.c. were as follows:
   sulfamic acid film ..... brownish gray
   oxalic acid film ..... pale yellow
   sulfuric acid film ..... pale yellow

C. Better affinity for dyes was obtained at room temperature by the 2 step film formation with sulfuric and sulfamic acids, preserving the other good properties of sulfamic acid film.

D. Properties of films formed by sulfamic acid with sulfuric acid added resemble those of sulfuric acid films. The effect of steam sealing was greater as the sulfuric acid content increased.

Acknowledgement

The authors are grateful to Mr. Shizuo Yamanaka for his assistance and to Nitto Chemical Company for the offer of sulfamic acid.

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Electrodeposition of Zinc on Uranium Metal*

By Louis Silverman, *North American Aviation, Inc., Downey, California*

PRESENT day interest in uranium is widespread, and studies concerning the physical and chemical properties of uranium metal are proceeding at many laboratories. The cladding of uranium metal by the more common metals is being investigated, and the study of electrodeposition of zinc on uranium metal was undertaken to ascertain if a satisfactory plating could be obtained.

The surface of newly-cleaned uranium metal is silvery white but quickly acquires a brown color when exposed to air; further, newly-cleaned uranium metal tarnishes in distilled water, as may be expected by reference to the position of uranium in the electromotive series of elements. The tarnish increases with time.

Protection against tarnish is necessary, and a non-aqueous liquid miscible, or partly miscible, with water is an evident suggestion. Carbitol (ethyl ether of diethylene glycol) which is both an alcohol and ether protects the silver-white surface of uranium metal for several hours.

As in other types of zinc plating, surface actants are desired, but for investigations involving metal-clad uranium, only non-metallic surface actants are permissible. Carbitol, again, fills this requirement.

In this paper, the cleaning cycle, the chemical plating bath and the plating operation are detailed.

Mechanical Set-up

It is advisable to rotate the metal sample so that the plating may be uniform. Uranium cylinders may be drilled and threaded so that one end of a similarly threaded steel cylinder may be screwed into the uranium cylinder while the other end of the steel cylinder is held by, or attached to, a rotating shaft such as that of an electric drill. Uranium disks which are to be plated on the outside circumference may be drilled and placed on a copper wire hook; copper wire will become the cathode.

Surface Defects

Zinc may be electroplated over metallic spots which contain oxygen, carbon or other impurities, but the zinc will not permanently adhere. These spots may be removed either mechanically, or chemically. Abrasion methods are adequate since the surface will be even after these types of treatment but chemical attack methods will preferentially dissolve the pure uranium and will leave uneven surfaces.

Cleaning Cycle

After removal of surface defects, the cleaning cycle is simplified. The metal is dipped into a warm solution of (1:1) nitric acid which dissolves the oxide coating and some metal. After an even stream of bubbles appears, the uranium metal is removed from the nitric acid solution and immediately dipped into distilled water, rinsed in a second bath of distilled water, momentarily drained, then immersed in a bath of carbitol. The metallic surfaces should remain silvery white for several hours.

Electroplating Bath

A zinc cyanide bath,[1] popularly described as a "Bright Zinc Cyanide Bath" was used.

	Oz./Gal.	g./L.
Sodium hydroxide	10.5	78
Sodium cyanide	5.6	42
Zinc cyanide	8	60
Sodium sulfide	0.1	0.75

Current density: 5 to 50 amperes per square foot
Temperature: 25-35°C.
Anode: Platinum
Plating thickness: 1.5 mils per hr., at 25 amp./sq. ft.

Place one-half the desired volume of water in a container. Add, and dissolve the sodium hydroxide, then the sodium cyanide and finally the zinc cyanide. Stir in the sodium sulfide. A black precipitate of lead sulfide usually appears. The black precipitate may either be filtered off, or decanted away from the liquid. After this, the solution is diluted to the pre-determined volume.

Since the zinc coatings on uranium metal are intended for research work, the economics of the plating bath are not to be considered. For this reason, a platinum anode is used, and the bath is to be discarded, before exhaustion.

Plating

The anode is set in place in the bath and the current is turned on. The uranium metal which was recently cleaned and stored in a bath of carbitol is lifted off and quickly (without drainage) immersed in the electrolytic bath as the cathode. After checking electrical connections and space arrangements, the cathode is set in motion, and a small amount of carbitol, about one per cent by volume, is added as surface actant.

The plating operation needs no further attention except for checking of the electrical instruments and the time of plating.

When the estimated plating time has elapsed, the uranium is removed from the bath (without switching off the current) and immediately washed with water. The coating may then be washed with alcohol and allowed to dry in air. Alternatively, the metal may be washed with water and then dipped in carbitol.

The coating may be buffed lightly to give a mirror-like finish.

Conclusions

Zinc may be electrodeposited on uranium metal.

It is found that the fresh silver-white surfaces of uranium metal can be maintained for several hours in carbitol, also that carbitol is useful as a surface actant.

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*This work is based on studies conducted for the Atomic Energy Commission under contract AT-11-1-GEN-8.

Nomogram for Analysis of Watts Type Nickel Plating Solutions

By I. Goldman, *Sylvania Electric Products Inc., Flushing, N. Y.*

A COMPREHENSIVE analysis of nickel plating solution is a step which fortunately the plater only rarely must undertake. His routine check usually consists of an analysis for total nickel, a chloride determination, a boric acid estimation, and a check on the pH. The operations are straightforward and their manipulation does not often give trouble. However, the arithmetic of calculating the proportions of $NiCl_2 \cdot 6H_2O$ and $NiSO_4 \cdot 6H_2O$ from the analytical results, has been found a source of trouble in the hands of the inexperienced operator.

To calculate the total amount of nickel in the solution, the usual procedure calls for the titration of a sample of plating solution with a standard solution of sodium cyanide.

For determination of chloride content, the titration is carried out using a standard solution of silver nitrate in the presence of potassium dichromate or dichlorofluorescine as an indicator. The number of equivalents of silver nitrate used enables calculation of the total chloride ion present.

Using these data, the analyst must go through calculations as follows:

(1) $$\frac{(\text{ml. } AgNO_3) \times (\text{normality of } AgNO_3)}{(\text{ml. of sample})} \times \frac{(\text{GMW of } NiCl_2 \cdot 6H_2O)}{2} = \text{g/l } NiCl_2 \cdot 6H_2O \text{ actually present}$$

(2) $$\text{g/l } NiCl_2 \cdot 6H_2O \times \frac{\text{GMW } NiSO_4 \cdot 6H_2O}{\text{GMW } NiCl_2 \cdot 6H_2O} = \text{g/l } NiSO_4 \cdot 6H_2O \text{ equivalent to actual g/l } NiCL_2 \cdot 6H_2O$$

(3) $$\frac{(\text{ml NaCN}) \ (\text{normality of NaCN})}{(\text{ml of sample})} \times \frac{(\text{GMW of } NiSO_4 \cdot 6H_2O)}{2} = \text{g/l } NiSO_4 \cdot 6H_2O \text{ based on total Ni.}$$

(4) Eq (3) — Eq (2) = g/l $NiSO_4 \cdot 6H_2O$ actually present.

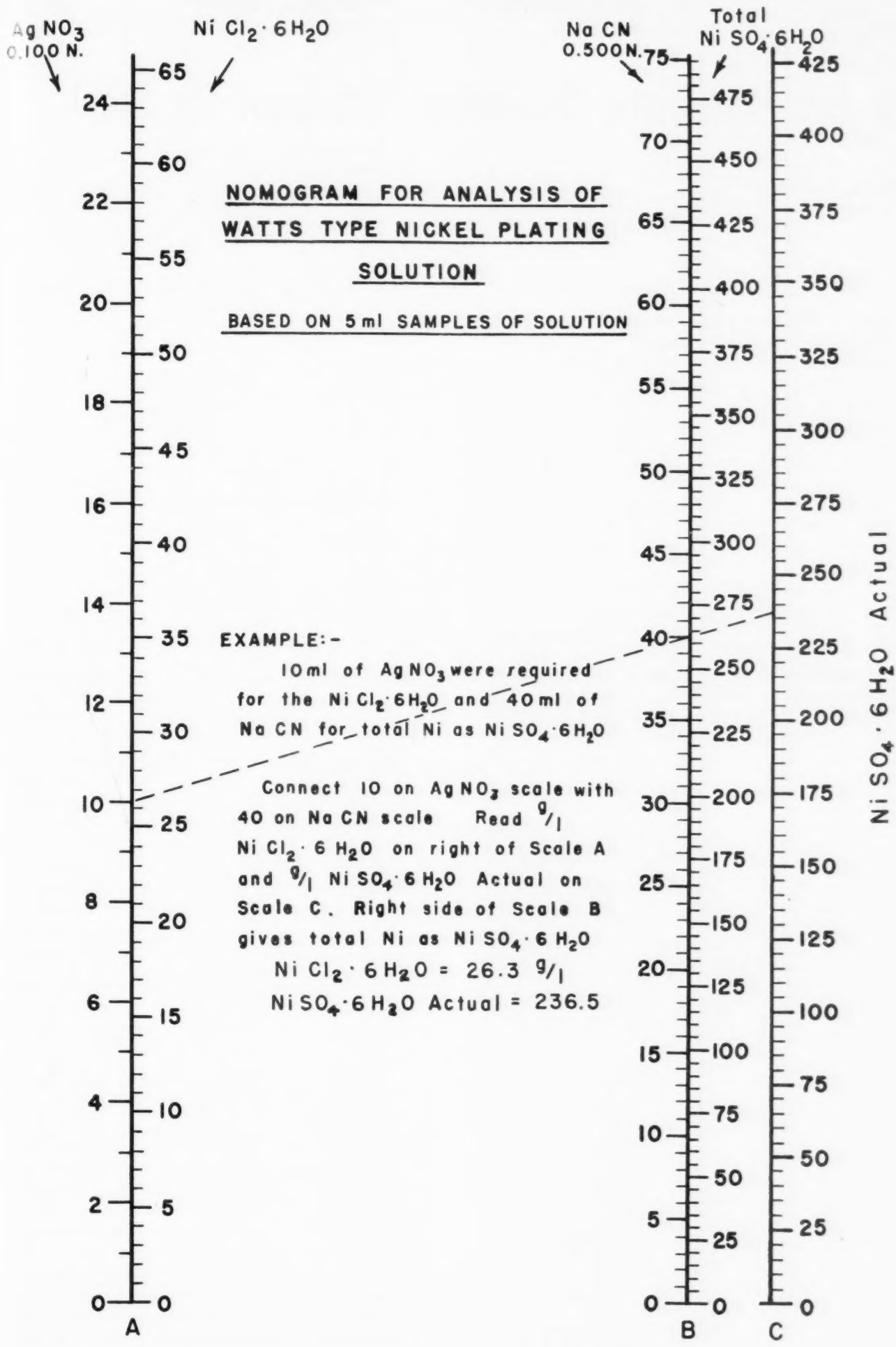
With standard stock solutions of titrants these calculations are not so formidable since, with fixed normalities and sample sizes, the equations are simplified. Moreover, some establishments are known to have prepared a series of graphs based on these equations which further reduces the necessary calculations. However, none of these methods are free from the possibility of making arithmetic errors. To eliminate arithmetic from the picture and, further, to speed up the process of getting the "answers" once the titrations have been performed, the accompanying nomogram has been prepared. This nomogram is based on a fixed sample size and titrant concentrations generally used in the field: i.e.

NaCN	= 0.500 N
$AgNO_3$	= 0.100 N
Sample size	= 5 ml.

Obviously, the nomogram is valid for only three conditions, but can be used for other normalities if the volume of titrant is corrected to these plotted values. In a similar manner, if different samples volumes are to be used, both reagent volumes will have to be corrected to the basis used in the nomogram.

It should be pointed out that it would be possible to construct a nomogram which could be used for a range of normalities of both titrants and also to compensate for various sample sizes. Such a nomogram would be cluttered with lines and might prove too complicated for use by shop personnel. Simple ratio type correction factors can be applied to extend the use of this simple 3 line nomogram to other than the basis conditions.

The technique of using the nomogram is simple and is described in the sample calculation inscribed within it. Accuracy obtained using this plot is adequate for all plating work and all scales are linear.


Ag NO3
0.100 N.
Ni Cl2 · 6 H2O
Na CN
0.500 N.
Total
Ni SO4 · 6 H2O
NOMOGRAM FOR ANALYSIS OF
WATTS TYPE NICKEL PLATING
SOLUTION
BASED ON 5 ml SAMPLES OF SOLUTION
EXAMPLE:-
10 ml of Ag NO3 were required for the Ni Cl2 · 6 H2O and 40 ml of Na CN for total Ni as Ni SO4 · 6 H2O
Connect 10 on Ag NO3 scale with 40 on Na CN scale Read g/l Ni Cl2 · 6 H2O on right of Scale A and g/l Ni SO4 · 6 H2O Actual on Scale C. Right side of Scale B gives total Ni as Ni SO4 · 6 H2O
Ni Cl2 · 6 H2O = 26.3 g/l
Ni SO4 · 6 H2O Actual = 236.5
Ni SO4 · 6 H2O Actual
A
B
C

A Non-Electrolytic Smoothing Treatment for Steel

By W. A. Marshall

Introduction

IN the course of other work it was observed that solutions containing oxalic acid and hydrogen peroxide exerted a marked smoothing action on steel, amounting with low carbon steels to a considerable degree of polish. Steel smoothed in the solution has been found to be in a suitable condition for subsequent electrodeposition of adherent nickel coatings. In addition to general use for brightening or smoothing steel, the method may be employed for simultaneously smoothing and etching steel samples for metallographic examination; it also has a potential use for etching steel articles without destroying polish prior to decorative plating.

The process described in this paper is the subject of a Patent Application No. 16578/51.

Solution Composition

The specimens used for this series of experiments consisted of wire nails (carbon content approx. 0.1%) which were degreased in trichlorethylene vapor followed by cathodic polarization in alkali. A brief (2 seconds) high current density anodic etch in 30% $\frac{W^*}{V}$ sulphuric acid was finally given to provide a standard surface. The specimens were immersed for part of their length in solutions of various known oxalic acid and hydrogen peroxide concentrations for fixed times at room temperature (20°C.). The polish produced was assessed by visual inspection during and after the treatment. It became apparent that the sulphuric acid used as stabilizer in the peroxide had some effect upon the smoothing action and an additional series of tests were therefore made with varying amounts of sulphuric acid present. Full results are given in Table I.

It will be seen from these that the following solution gives good smoothing in periods of one hour at room temperature:

Oxalic acid	2.5% $\frac{W}{V}$
Hydrogen peroxide	1.3% $\frac{W}{V}$
Sulphuric acid	0.007-0.010% $\frac{W}{V}$

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TABLE I.—EFFECT OF VARIATION OF SOLUTION COMPOSITION

$H_2C_2O_4.2H_2O$ % $\frac{W}{V}$	H_2O_2 % $\frac{W}{V}$	H_2SO_4 % $\frac{W}{V}$	Time hrs.	Results
15	1·95	0·011	2	Coated with dark grey film and severely etched.
10	"	"	"	
5	"	"	"	Rapidly brightened.
2·5	"	"	"	Rapidly brightened—optimum.
1·0	"	"	"	Dull smooth surface.
2·5	0·65	0·0035	1	Coated with grey film—etched.
"	1·3	0·007	"	Rapidly brightened—optimum.
"	1·95	0·011	"	Fine matt surface.
"	2·6	0·014	"	Semi-bright.
"	3·25	0·017	"	
2·5	1·3	nil	1	Fine matt surface.
"	"	0·005	"	Semi-bright.
"	"	0·0075	"	Bright.
"	"	0·010	"	Bright-optimum.
"	"	0·025	"	Fine matt surface.

* The term % $\frac{W}{V}$ used throughout denotes gm. of substance per 100 ml. of solution.

This composition was used for all the work described in this paper, except where the use of stronger solutions having the same ratio of components is specifically mentioned.

With the solutions in which brightening occurred, periodic gas evolution at intervals of 3-4 seconds took place at the surface of the steel, whereas the solutions which did not brighten satisfactorily, gave, in general, continuous gas evolution. The gas thus periodically evolved was collected and found to be essentially oxygen. Absorption with alkaline pyrogallol gave a figure of 95% O_2, which was probably a low result.

Effect of Varying Total Concentration While Maintaining the Optimum Ratio of Constituents

Solutions were prepared having the following compositions:—

Composition	A	B	C	D	E
Oxalic acid % ...	1·0	2·5	5·0	7·5	10·0
Hydrogen peroxide %	0·52	1·3	2·6	3·9	5·2
Sulphuric acid % ...	0·003	0·007	0·014	0·021	0·028

Thus the solutions were respectively 0.4, 1, 2, 3 and 4 times the concentration of the solution already described.

A degreased and etched nail was immersed in each solution and the smoothing effect observed.

All the specimens were brightened. Solution A gave a somewhat coarsely etched but bright surface. The remaining four gave smooth bright surfaces. Periodicity of gas evolution occurred in every case. The

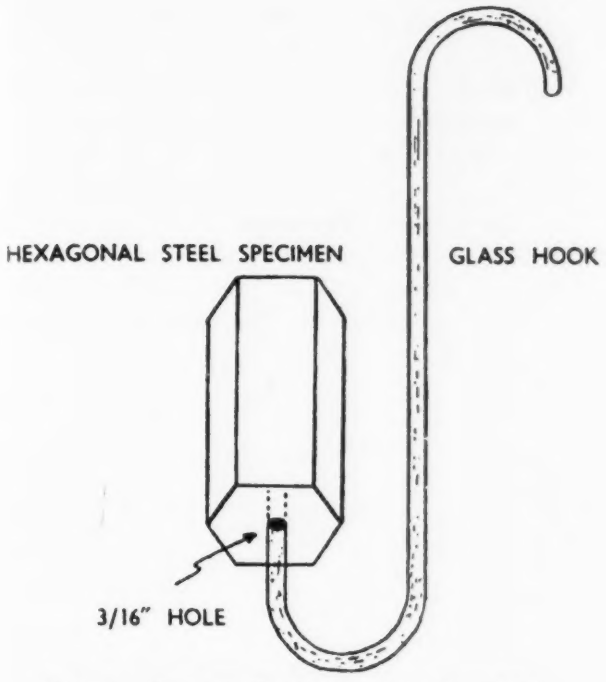


Fig. 1.—Hexagonal specimen on glass hook.

interval was again 3-4 seconds. The rate of smoothing increased with increasing concentration of solution. Thus Solution E gave a brighter surface in 10 minutes than was given by B in one hour or by A in 2½ hours. The temperatures of the solutions, initially 20°C., rose in 2 hours to the following values:

Composition:	*A*	*B*	*C*	*D*	*E*
°C:	22.0	22.9	25.2	27.7	30.6

This confirms qualitatively that the reaction is more vigorous in stronger solutions.

A short piece of bright drawn hexagonal steel bar approximately $1\frac{1}{16}$" long × ¼" side of face was rubbed down to 0 grade emery paper on all faces. It was supported by a glass hook inserted into a $\frac{3}{16}$" diam. hole drilled longitudinally for about ¼" from one end face as shown in Fig. 1, so as to hang nearly vertically. After degreasing and lightly etching, it was immersed in Solution E. The steel was effectively brightened in 10 minutes but only the upper faces remained smooth. Vertical and under faces were severely grooved along the lines of gas flow. This effect of position was not noticed with the Solution B in experiments described in the next section, in which all faces became smoothed.

Rate of Solution of Mild Steel and Time Required for Optimum Brightening

Micrometer measurements had indicated that the rate of attack on mild steel was of the order of 0.0005 in. per hour. A more accurate determination was carried out upon the small specimens of bright drawn hexagonal steel bar described in the previous section. Eight of these were prepared on all faces by rubbing down to 0 grade emery paper. One was kept for comparison and the remaining seven were degreased and carefully weighed. They were suspended on glass hooks as before and immersed in one liter of the normal solution at 18°C. Specimens were removed at

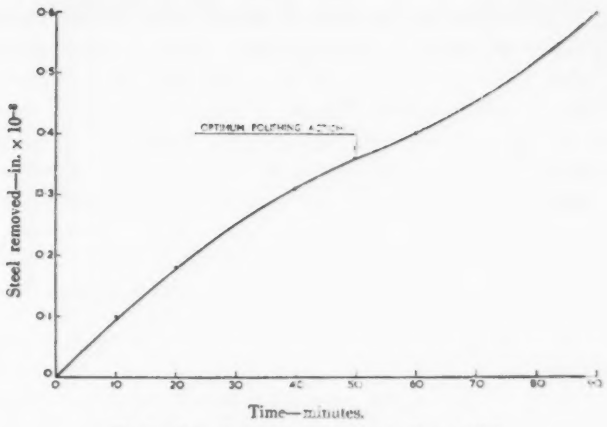


Fig. 2.—Rate of solution of mild steel—Temp. 18°C.

10, 20, 30, 40, 50, 60 and 90 minutes after immersion, rinsed, dried with alcohol and warm air and, after cooling, reweighed. From the area of the specimens, calculated to be 1.92 sq. in., and assuming the specific gravity of steel to be 7.8, the thickness of steel removed was calculated. The maximum temperature variation during the experiment was ± 0.5°C.

The results are shown in Fig. 2. Photographs were taken to illustrate the comparative reflectivity of the specimens, including the untreated steel (Fig. 3); also photomicrographs (× 100) were taken in order to study the development of grain structure (Fig. 4).

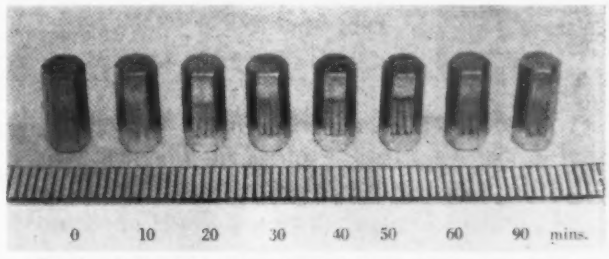


Fig. 3. Reflectivity of specimens before and after treatment (× ½).

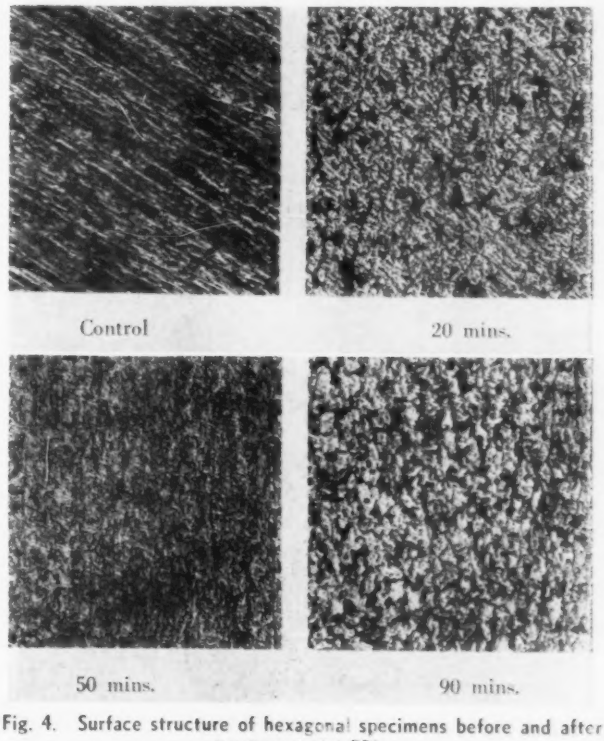


Fig. 4. Surface structure of hexagonal specimens before and after treatment (× 80).

The specimens showed a steady increase in luster up to 50 minutes, with a marked deterioration at 60 and 90 minutes. This was confirmed by a surface structure, shown in Fig. 4.

Thus optimum brightness was produced on mild steel after abrasion on No. 0 emery paper in 50 minutes at 13°C., with the removal of approximately $\frac{1}{3} \times 10^{-3}$ in.

Effect of Agitation during Treatment

A hexagonal mild steel specimen, rubbed down as usual on 0 grade emery paper, was weighed and treated for one hour in the solution without agitation. After washing and drying, it was reweighed and the thickness of steel removed was calculated from loss of weight, area and sp.gr. of steel.

Using the same specimen, the experiment was repeated, using mechanical rotation of the steel for one hour at 70 r.p.m. The thickness of steel removed was calculated as before. Temperatures before and at end of experiment were recorded in both cases. Results are shown in Table II.

TABLE II.—EFFECT OF AGITATION ON RATE OF ATTACK

	Loss (in. × 10^{-3})	Temp. Range	Time
Still ...	0·36	19·4—20·2°C.	1 hour
Rotated ...	0·82	19·9—21·6°C.	

The specimen after rotation had a less satisfactory polish than it had when treated in still solution.

Effect of Temperature on Rate of Attack

Four hexagonal specimens of mild steel were prepared on 0 grade emery paper, degreased, lightly etched, weighed and suspended in portions of solution maintained within close limits at 10°, 20°, 30° and 40°C. respectively. After treatment for one hour, the specimens were washed, dried and reweighed. The thickness of steel removed was calculated as usual.

Results are shown in Fig. 5.

The higher rate of attack in these experiments (*cf.* Table II) is attributed to the frequent stirring necessary for temperature control.

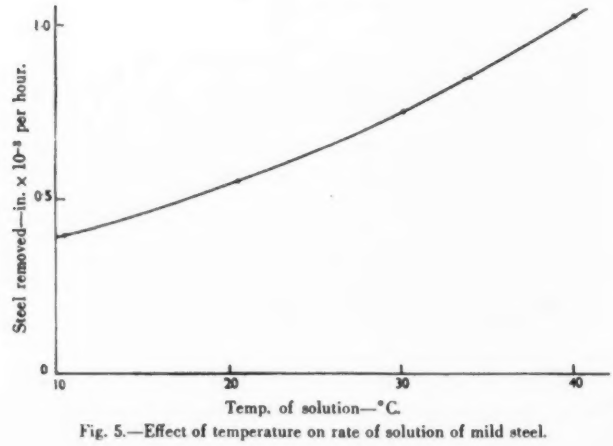


Fig. 5.—Effect of temperature on rate of solution of mild steel.

Treatment of Higher Carbon Steels, Alloy Steels and Cast Iron

The experiments previously described were all made upon low carbon mild steel. Other ferrous materials tried in the solution include:

(a) A series of seven carbon steels of carbon content ranging from 0.13% to 1.13%, in the as-cast and normalized condition;

(b) Samples of two alloy steels, V.10 and V.11, having compositions which fall within the following limits:

	V10	*V11*
C	0.35-0.43	0.22-0.35
Si	0.10-0.35	0.3 max.
Mn	0.50-0.70	0.4 -0.8
S	0.05 max.	0.05 max.
P	0.05 max.	0.04 max.
Ni	1.3 -1.8	2.0 -3.4
Cr	0.9 -1.4	0.5 -1.0
Mo	0.2 -0.35	0.35-0.8
V		0.25 max.

and *(c)* Samples of gray and malleable white heart cast iron.

Specimens of each material were rubbed down to 0 grade emery paper, degreased and suspended in the solution for one hour at room temperature. With V11 steel, the rate of solution of the steel was determined as already described for mild steel, by loss of weight of specimens of measured area. These results are shown in Fig. 6. The curve for mild steel is included for comparison.

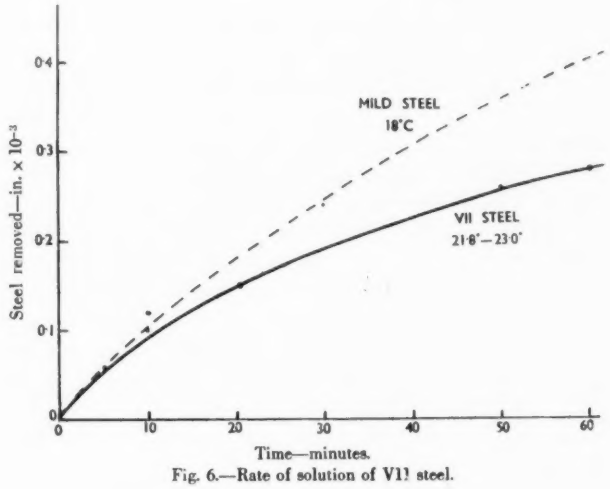


Fig. 6.—Rate of solution of V11 steel.

(a) Higher carbon steels: The emery scratches were virtually obliterated on every specimen. All the specimens showed a radiating crystalline structure probably due to their having been cut transversely from a cast rod. Only the steel with lowest carbon content (0.13%) showed appreciable reflectivity, the remainder being smoothed and semi-bright. The two specimens with highest carbon content (0.85% and 1.13%) showed bluish stains on the treated surfaces.

(b) V10 and V11 alloy steels: With both steels a dark gray film ("smut"), easily removed by gentle rubbing or forcible hosing with a water jet, was formed. Below this, the steel was found to be smooth

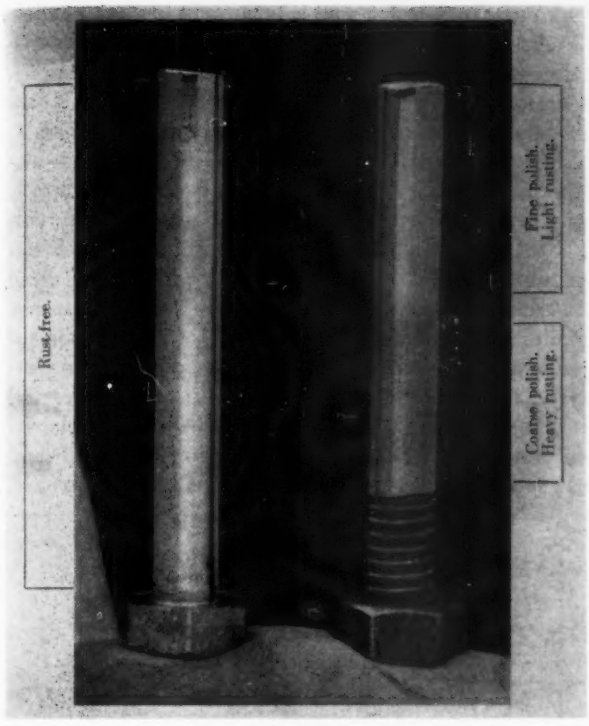


Fig. 7. Mild steel polished in solution and hand polished, after 10 days' exposure.

and semi-bright. The characteristic periodicity of gassing also occurred, but with a much longer interval (about 21 seconds) than with low carbon steels.

(c) Grey and malleable white heart cast iron: The grey cast iron became coated with a black, rather strongly adherent film, below which the iron had a fine matt surface. It was suspected that very rapid but feeble periodicity of gassing was taking place. With malleable cast iron, considerable brightening, accompanied by normal periodicity of 3-4 seconds interval, was observed.

Evidence of the Formation of a Protective Film

Observations of the periodicity of gassing, which seems to be associated with the polishing action, suggests that film formation occurs during treatment of steel in the solution; also, inhibition of rusting upon exposure of treated specimens, together with some effects discussed later in this paper, further suggests that a protective film persists upon the steel after treatment. In the exposure test, two portions of the same mild steel bolt were used. One portion was degreased and brightened in the standard solution; the other was mechanically polished with grade 00 emery paper and a part of the surface further polished with alumina paste on selvyt. Both portions were thoroughly washed, dried with acetone and exposed together to the laboratory atmosphere in an uncovered shallow glass dish.

In three days, slight rusting could be seen on the mechanically polished specimen. In four days this sample showed definite redness. Meanwhile the portion brightened in solution remained unchanged. After ten days the specimens were photographed (Fig. 7). The more highly polished portion of the mechanically polished specimen showed less tendency to rusting than the coarsely polished portion, so that surface smoothness may have been a factor contributing to the absence of rust on the solution-polished specimen. However, the complete absence of rust on this specimen suggests the presence of a protective film, and the existence of this has been confirmed and its nature investigated in a research directed by Dr. A. Hickling, of Liverpool University. This work is the subject of a separate paper.[1]

Quantitative Assessment of Smoothing Effect Upon Steel Surfaces

The treatment appears to have an application as an alternative to super-finishing for machine components.

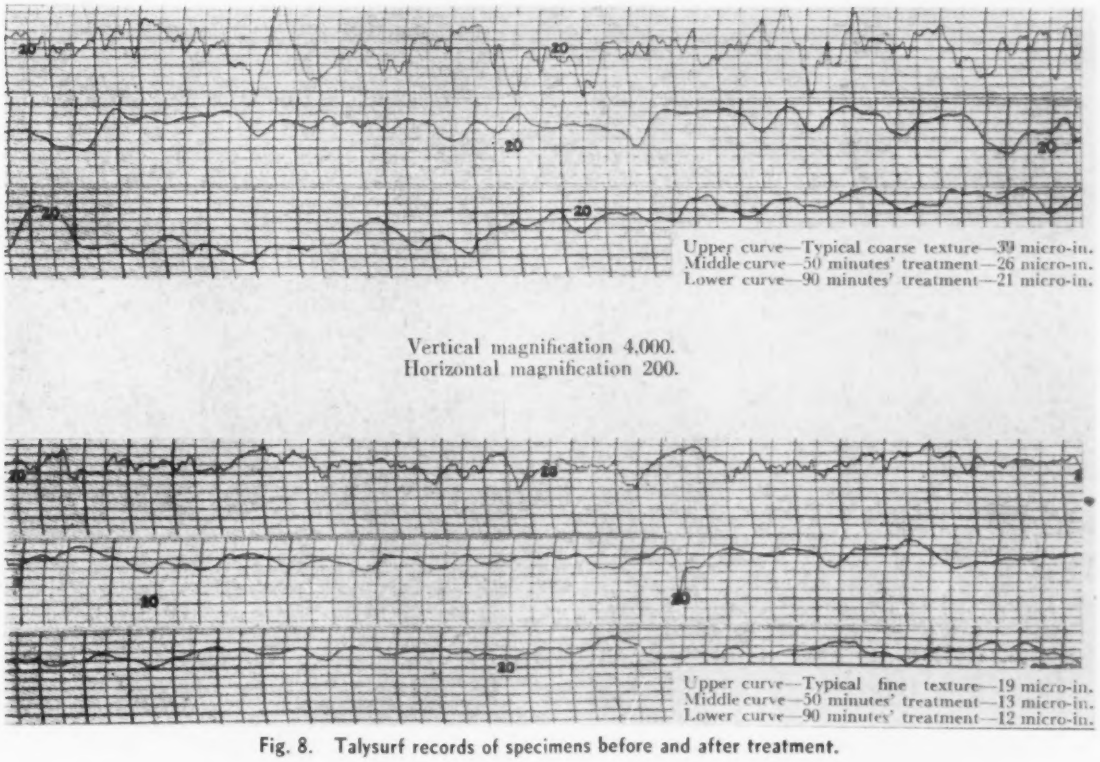


Fig. 8. Talysurf records of specimens before and after treatment.

In preliminary exploratory work it was decided to study the effect upon mild steel specimens before proceeding to higher carbon and alloy steels such as are likely to be used for constructional purposes.

Specimens 2" × 1" × ¼" thick were prepared from normalized lead-free mild steel. One face of each was ground for half its length with a texture of 40 micro-inches and for the remainder with a texture of 20 micro-inches. The direction of grinding was parallel to the 1" edge of face. Each specimen was provided with a small hole for suspension and a stamped identification mark. The texture of every specimen was recorded on both fine and coarse areas by means of the integrating meter of a Talysurf instrument. Three specimens were investigated in detail and Talysurf records were drawn on both textures of each. A typical pair of these records is reproduced in Fig. 8 (upper curve of each group).

The same three specimens were photographed so as to indicate their reflectivity (Fig. 9) and also × 100 on both textures to show the initial surface condition. Fig. 10 includes a typical pair of these photomicrographs.

All the specimens were carefully weighed and stopped-off with lacquer on the back face only, so as to leave the prepared face and all edges exposed. This was intended to provide information as to whether contours, e.g. 90° corners, would be affected by the action of the solution. The specimens were then degreased, anodically etched at high current density in 30% sulphuric acid for a very brief period (1 second), washed and suspended by means of glass hooks in the smoothing solution at room temperature (20°C.). They were withdrawn in numerical order at intervals of 10, 20, 30, 40, 50, 60 and 90 minutes after immersion, washed, stripped of the lacquer film, dried and reweighed. From the loss of weight, assumed specific gravity of steel (7.8) and nominal surface area was calculated the apparent thickness of steel removed and the rate of attack per hour for each period of immersion. These results are shown in Table III and plotted in Fig. 11. The results for hexagonal mild steel specimens prepared on 0 grade emery paper (Fig.

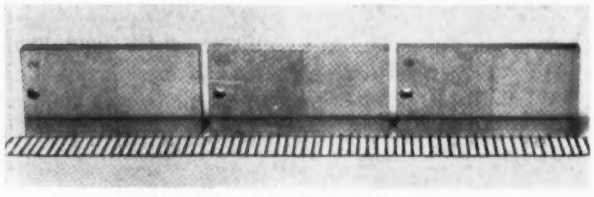
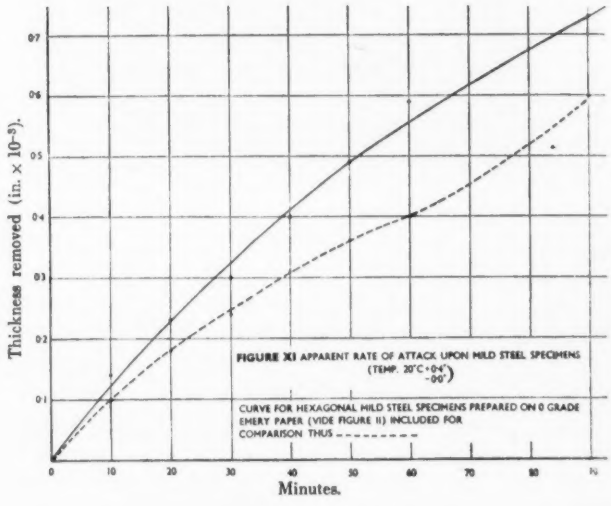


Fig. 9. Reflectivity of ground specimens.



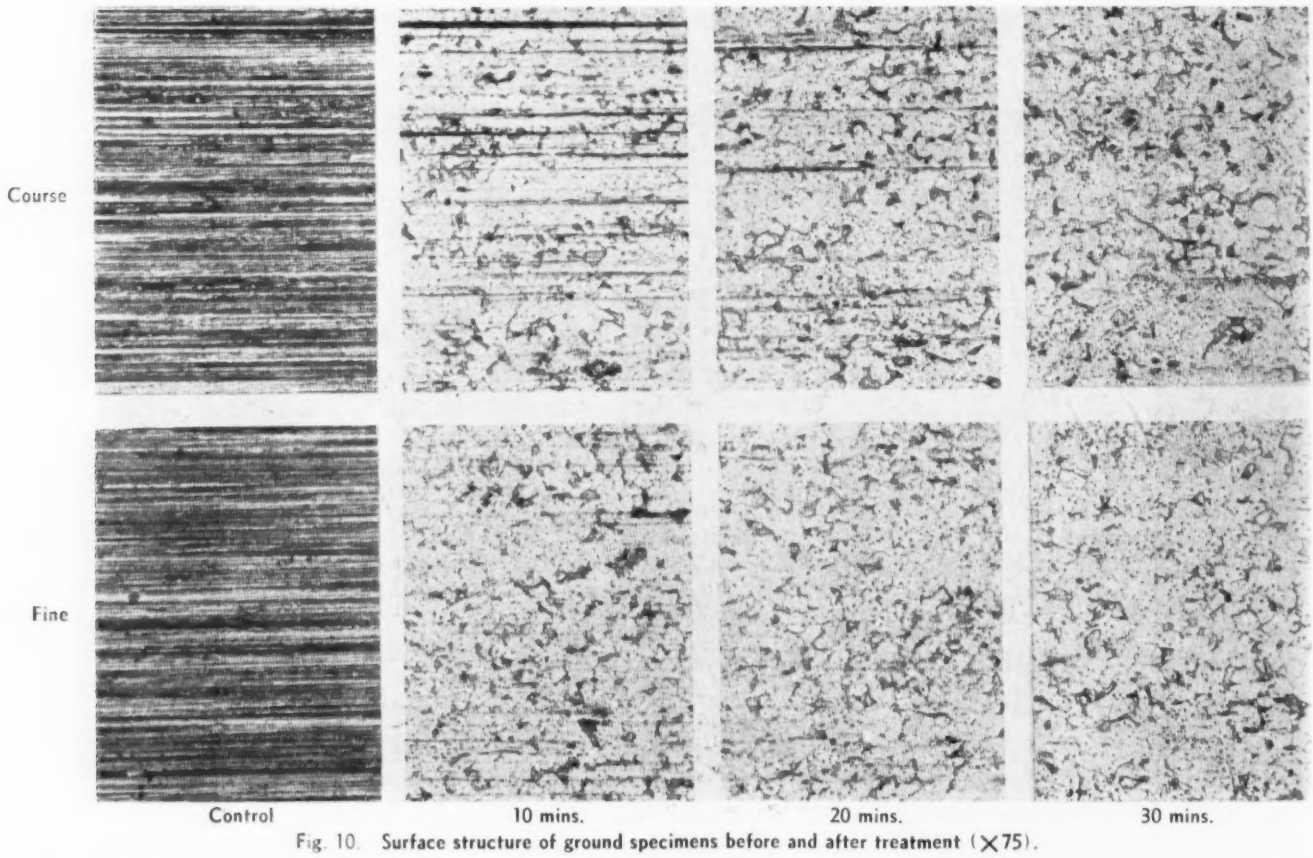


Fig. 10. Surface structure of ground specimens before and after treatment (×75).

TABLE III.—CONDITION OF SPECIMENS BEORE AND AFTER TREATMENT

Specimen No.	Time of Treatment (mins.)	Surface Texture (micro-in.)				Thickness of Specimen (inches)				Flatness (T)				Thickness removed (in. x 10^{-5})					
		Coarse		Fine		Coarse		Fine		Coarse		Fine		Calculated (average)		Measured			
																Coarse		Fine	
		Before	After	Before	After	Before	After	Before	After	Before	After	Before	After	Loss	Rate per hr.	Loss	Rate per hr.	Loss	Rate per hr.
1	10	39	30–35	18	16	0·25493	0·25478	0·25534	0·25542	0·6	0·7	0·7	0·7	0·14	0·84	0·15	0·90	—	—
2	20	38	28–31	19	15	0·25491	0·25471	0·25534	0·25537	0·5	0·5	0·6	0·6	0·23	0·69	0·20	0·60	—	—
3	30	40	30	18	13–16	0·25488	0·25464	0·25535	0·25512	0·6	0·5	0·3	0·4	0·30	0·60	0·24	0·48	0·23	0·46
4	40	42	26	20	14–16	0·25484	0·25464	0·25531	0·25510	0·5	0·6	0·5	0·5	0·40	0·60	0·20	0·30	0·21	0·31
5	50	40	26	19	13	0·25476	0·25451	0·25521	0·25484	0·2	0·3	0·3	0·4	0·49	0·59	0·25	0·30	0·37	0·44
6	60	39	24–27	20	11	0·25484	0·25451	0·25522	0·25493	0·2	0·2	0·2	0·5	0·59	0·59	0·33	0·33	0·29	0·29
7	—	41	—	18	—	0·25484	—	0·25518	—	0·4	—	0·3	—	—	—	—	—	—	—
8	90	39	21	19	12	0·25480	0·25426	0·25534	0·25485	0·5	0·6	0·4	0·7	0·73	0·49	0·54	0·36	0·49	0·32
9	—	40	—	19	—	0·25478	—	0·25527	—	0·5	—	0·4	—	—	—	—	—	—	—

2) are included in Fig. 11 for comparison. The determinations of surface texture, thickness and flatness were repeated (Table III) and Talysurf records were taken of the three typical specimens previously examined. The records for the 50 minute and 90 minute specimens are reproduced in Fig. 8. Photographs were taken to indicate the comparative reflectivity of the treated specimens (Fig. 12) and photomicrographs × 100 were also taken to illustrate the condition of both coarse and fine textures after treatment (Fig. 10). The rate of attack was calculated from the thickness measurements and is included in Table III.

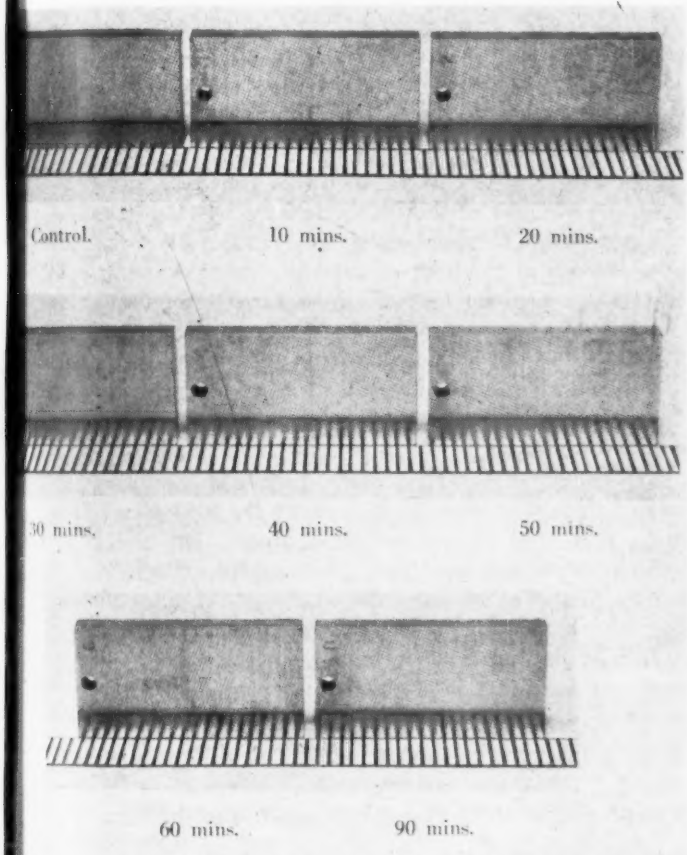


Fig. 12.—Reflectivity of specimens before and after treatment.

Fig. 13.—Grooved structure.

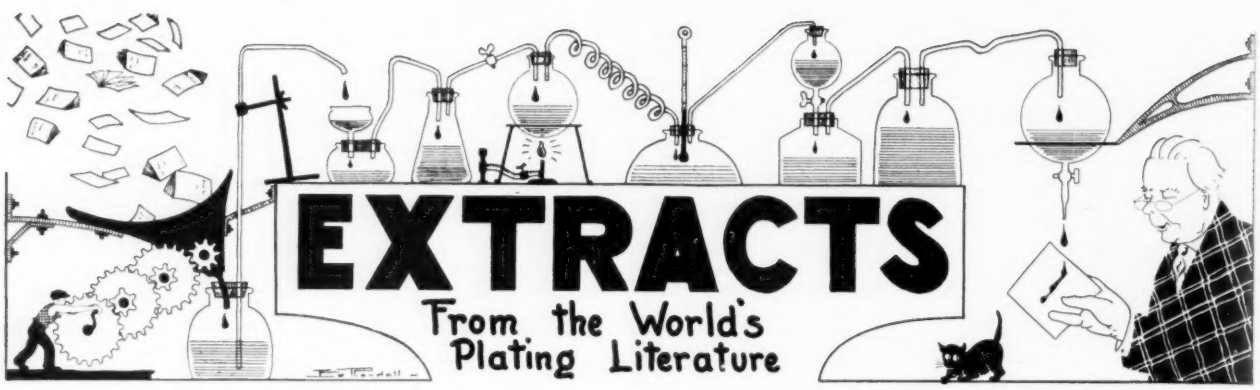
All specimens treated for 30 minutes and over developed a peculiar longitudinal grooved structure, i.e. at right-angles to the grinding texture. This effect is illustrated in Fig. 13 and discussed below.

It is apparent from Fig. 12 that neither the coarse nor the fine textures were completely smoothed by treatment for times up to 90 minutes. This observation is confirmed by the Talysurf records (Fig. 8), which do, however, indicate that finer textures of probably 10 microinches and under may be effectively smoothed by the treatment. Small irregularities of this order, superimposed as a secondary texture on the ground surfaces, were removed, while the general texture was only partially smoothed. The records shown in Fig. 8 were taken on coarse and fine textures (1) as ground, (2) after 50 minute and (3) after 90 minute immersion. Further work is proposed using specimens prepared on finer abrasives to give textures of the order of 10 microinches and under.

Fig. 12 shows that there was a progressive increase in reflectivity over the whole period of 90 minutes. The optimum at 50 minutes observed in the earlier experiment did not occur; this is confirmed in the photomicrographs (Fig. 10) which do not show an optimum surface condition. Grain etching has occurred in every specimen. It should be appreciated that the striking change in appearance produced in the first 20-30 minutes implies that the rough edges of the original grinding furrows have become rounded. Hence the monocular microscope with vertical illumination gives an impression of smoothness which is largely illusory.

Table III and Fig. 11 indicate an apparent rate of attack calculated from loss of weight of ca. 0.6×10^{-1} in. per hour, which is appreciably higher than that observed for mild steel specimens prepared on 0 grade emery paper (Fig. 2). The rate of attack measured by difference of actual thickness is, in general, of the order of one-half of this amount. With textures as coarse as those used in the present experiments, it is obvious that the true surface must be appreciably greater than the nominal area of the specimen. For example, assuming that the grinding grooves approximate in cross section to equilateral triangles, the true area will be twice the apparent surface area. Hence the rate of attack will appear greater when calculated from loss of weight than when physically measured, as is shown by Table III. The table also indicates gen-

(*Continued on page* 85)



Simplified Analytical Procedure for Potassium Cyanide Baths

W. Savelsberg; *Metalloberflaeche*, vol. 5, No. 8, pp. B116-B117.

An outline of the simplified test method given is as follows. In cyanide plating baths, complex ions are present such as $K[Ag(CN)_2]$, $K[Cu(CN)_2]$, $K_2[Zn(CN)_4]$ etc. The anion part of this complex is slightly dissociated so that $Ag(CN)_2^- = Ag^+ + 2CN^-$. This dissociation is so slight that these ions show no reaction with most reagents when in complex solution. An exception is provided by silver, cadmium and zinc when in solution as a potassium cyanide complex and these metals can be precipitated from these complex ions with hydrogen sulfide. A simple analysis procedure, accordingly, suitable for conducting by a foreman with a little training, is to precipitate by means of sodium sulfide solution to which some caustic soda has been added to make it more stable. This avoids all difficult gravimetric precipitation, filtering, ignition to oxide and weighing, as the sodium sulfide determination is conducted volumetrically. As no color change is available to indicate the end of the titration, the end point is ascertained by the usual drop test on a white plate. The most sensitive reagent for the sulfide ion is lead acetate which is colored dark by the slightest trace. The analytical procedure consists in titrating a measured volume of the bath liquid with a standard sodium sulfide solution with the drop test made with lead acetate towards the end of the reaction. The solution to be analyzed must be hot and it is preferable to bring it to the boiling point before the beginning of the titration.

1 cc. of N/10 Na_2S solution corresponds to 10.785 mg. of silver, 5.6 mg. of cadmium or 3.27 mg. of zinc. It is best to prepare the solution so that 1 cc. = 5 mg. of the metal being determined. For this it is necessary to dissolve:

a). For the silver determination	5.55	g./L.	$Na_2S.9H_2O$
b). For the cadmium determination	10.6	"	"
c). For the zinc determination	17.8	"	"
A N/10 solution contains	12	"	"

The lead acetate solution is prepared by dissolving 5 g. of lead acetate in 1 liter of water with the addition of enough acetic acid that the salt dissolves to form a clear solution. Lead acetate indicator paper may also be used. To standardize the titration, a N/10 iodine solution is prepared by dissolving 12.7 g. of iodine in a solution of 30 g. of potassium iodide in 1 liter of water. The titration is based on the following reaction:

$$Na_2S + 2\,I = 2\,NaI + 2S$$

i.e. 1 cc. of N/10 iodine solution = 1 cc. N/10 Na_2S solution. The iodine solution is run from the burette into the measured and diluted Na_2S solution to which a few drops of a freshly prepared starch solution have been added. The first excess drops of iodine solution give a blue coloration with the starch.

The determination itself is then very simple. A measured vol. is taken of the bath solution; for simplified calculation this volume is preferably 5 cc. This measured volume of the bath solution is diluted with distilled water to about 150 cc. (in an Erlenmeyer flask) and the solution is then heated almost to the boiling point. During the heating the drop test places in the test plate have been filled with the lead acetate solution. The progress of the titration reaction is followed by repeated testing on the drop test plate.

The end point has been reached when the solution taken from the titration beaker colors the lead acetate drop on the test plate a yellowish brown. The cc. of sodium sulfide solution used are the read off on the burette. With 5 cc. of bath solution, the silver, cadmium and lead contents respectively are given directly in g./liter if the solutions have been weighed out and made up according to the amounts given under (a), (b) and (c). As the first titration is usually overrun, the titration is usually repeated a second time.

Coating Test for Tinned Copper Conductors

M. Zuercher and J. Lueder; *Bulletin des Schweizerischen Elektrotechnischen Vereins*, vol. 42, p. 271.

An improvement on the *Schuermann* and *Blumenthal* test for tinned coatings is described, which consists in controlling the influence of the diffusion by intensive stirring. This gives specific test results which are well reproducible. The factors which influence the solution reaction quantitatively were studied individually and a suitable working test procedure was developed from the data obtained.

Tinned pieces of copper wire of 20 to 30 sq. cm.

total surface area were used. The wire ends were protected by tinning and, in the case of stranded wire, the individual wires were fastened together in one or more bundles. The pieces of wire were degreased by a double immersion in freshly distilled chloroform and, after drying, inserted in the openings of the stirrer which was rotated during the test at 1,100 r.p.m.

The ammoniacal persulfate solution was prepared by taking 26 cc. of concentrated ammonia (27%), and diluting to 260 cc.; then 2.6 g. of ammonium persulfate were added and 130 cc. of this solution were immediately passed into the test jar and stirred for 10 minutes. For the determination of the dissolved copper, the 130 cc. of the ammonium persulfate solution which had not been used was reacted from a micro-burette, drop by drop, with copper sulfate solution, until the solution showed the same color tone as the test solution. The copper sulfate solution contained 30 mg. of copper per cc. and was prepared by dissolving 29.46 g. $CuSO_4 \cdot 5H_2O$ in 250 cc. of water. A colorimeter is preferable for the color comparison, for example the Zeiss Pulfrich photometer or a similar instrument. The amount of copper dissolved is calculated from the amount of copper sulfate solution used and from the wire surface area used in the test and is determined as mg. copper per 20 sq. cm. of wire surface area. For a satisfactory tin coating, an amount of copper of less than 20 mg. copper per 20 sq. cm. tinned wire surface area will be the test specification requirement.

Chemical Degreasing Techniques

O. Vogel; *Galvano* (Paris), vol. 21, No. 180, pp. 11-13.

Chemical degreasing of metallic parts can be achieved in three different ways: (1) By means of emulsifying materials; (2) By saponification in boiling alkalies; (3) By the use of materials with adequate degreasing power. The majority of the emulsifying agents are degreasing materials. In these degreasing baths, the fatty material is merely emulsified, i.e. it is not dissolved but is separated from the liquid in the form of fine droplets. The emulsions arising from the degreasing of metals are not generally stable emulsions; they are formed at the surface of the object being treated, then they dissolve, precipitate once more and the oil or grease then rises to the surface of the bath. Various factors must be taken into consideration to appraise the value of detergent mixtures. It is known that soap is a most effective emulsifying agent and even though it is a cheaper material than some alkaline chemical detergents, this is not nevertheless, the whole picture.

Trisodium phosphate solutions used as a detergent, lose the oil removed at the end of several hours, by breaking of the emulsion. On the contrary, soap solutions form stable emulsions and in use become gradually poorer in soap and in detergent power. The emulsion which is formed by means of a good alkaline detergent should not be too stable; after several hours rest the oil should detach itself and rise to the surface of the bath. Caustic soda has a tendency to form stable emulsions to a lesser extent than soap solutions but greater than that of trisodium phosphate and sodium carbonate solutions. Opinion varies regarding the emulsifying power of sodium silicate. The detergent power of soap is increased more by sodium silicate than by other alkalies such as caustic soda.

The soap solutions degrease in proportion to their lathering characteristics; if the lathering power is reduced because of dirt accumulation, then they are without value. Alkaline solutions containing rosin soaps are very satisfactory because they give good rinsing. Increase in the pH of the solution activates the emulsifying action but diminishes the stability of the emulsion and this facilitates the rising of the oil and grease to the surface.

Boiling, or immersing the objects to be degreased in boiling detergents acts in a more effective manner than emulsifying materials.

Rapid cleaning solutions for plating pretreatment should have a perfect degreasing action and be easily rinsed. A suitable analysis is: Trisodium phosphate 50-70%; sodium carbonate 40-20%; soap as required. 10%. Detergent solutions for light cleaning duties contain a high proportion of trisodium phosphate with the addition of sodium carbonate and sodium borate. For general degreasing duties, a detergent solution containing matter in suspension has the following composition: caustic soda 42%; sodium carbonate 3%; sodium silicate 18%; insoluble materials 12%; water 25%.

If the emulsifying action is of the first importance, the effectiveness is often due to the capacity of forming emulsions with the oil to be removed. Other factors which also need to be taken into consideration are (1) the dissolving power — the alkaline materials have only a slight dissolving action on the metallic oxides; (2) the saponifying power — animal and vegetable oils saponify easily with alkali and become soluble in water; (3) adsorption — fine particles of greasy dirt are adsorbed by the lather.

NON-ELECTRIC SMOOTHING

(*Continued from page* 83)

erally a higher rate of attack in the earlier part of the period of immersion, which is to be anticipated with a treatment producing progressive surface smoothing. The discrepancies at 10 and 20 minutes with the fine texture, where the difference in thickness is apparently negative, are due to the thicknesses being measured at points on a surface which has a variation in flatness of 0.6-0.7 T (0.00006-0.00007 in.): this is greater than the apparent discrepancy.

The longitudinal grooving shown in Fig. 13 was observed on all specimens treated for 30 minutes or longer; it became increasingly noticeable with increased time of treatment and was most conspicuous on the specimen treated for 90 minutes, which is illustrated. The effect is attributed to uneven work-hardening of the surface layers of the steel by the planing operation which preceded the final grinding. Solution of the steel apparently proceeds at differing rates dependent on the degree of work-hardening of the metal, so that a furrowed surface is developed.

(*To be concluded next month*)

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Silver Depositing on Steel Tank

Question: We recently obtained a new steel tank for our silver strike solution and find that silver is depositing on the sides and bottom of the tank. The tank was cleaned out well and the scale pickled off before being put into use.

Answer: Steel tanks are satisfactory for silver cyanide solutions providing the black mill scale is left on the steel. Your trouble is due to the scale being pickled off of the steel and exposing the clean steel beneath. The potential between this and the silver anodes hanging in the solution can be as much as ¼ of a volt with the generator off and this means that silver is being continuously deposited at least at ¼ volt pressure.

The best thing to do would be to have the tank lined with a material that is compatable with silver plating solution. An alternate method would be to clean out the tank thoroughly and fill with a weak solution of acetic acid and allow to stand for a few hours. Rinse out well and dry the surface and paint with either asphalt or some other resistant paint.

Rhodium Solution

Question: How can one tell whether a rhodium solution needs metal? Is there a way to determine whether or not the bath needs sulfuric acid?

Answer: Your rhodium supplier sells a kit for determining rhodium metal in a bath and these kits are accurate within 0.1 g./l.

The proper amount of sulfuric acid may be determined by the conductivity of the bath. A low acid concentration will show a drop in amperage for a given voltage and will show a slow evolution of gas on the work. All rhodium replenishing solutions have some excess acid which automatically makes up for losses.

The acid content can easily be determined by titrating with standard sodium hydroxide solution, using methyl orange indicator.

Where to Get It

Question: Will you please let us know where in this country we can get the book "The Analysis of Electroplating and Related Solutions." This is the book from which the reprint "Chemical Analysis and Control of Alkaline Metal Cleaners" in your March, 1952 issue was taken.

A. P. B.

Answer: We know of no source in this country but the book can be obtained by forwarding an International Money Order, obtained from your branch post office, to Electroplating & Metal Finishing, 83 Udney Park Road, Teddington, Middlesex, England.

Increasing Voltage in Rhodium Solution

Question: I would appreciate your advising me what to do to get more voltage in my Rhodium. I had to plate a large diamond piece and had difficulty in getting into the deep recesses, such as the center of a cluster of diamonds shaped like roses.

H. S.

Answer: More voltage in your rhodium solution can be obtained by increasing the acid content as this ingredient may be low. However, we would suggest that, rather than adding acid, a sample should be sent to the supplier of the rhodium solution for analysis first.

Other causes of low voltage would be too small an anode surface, poor contacts, insufficient thickness of busbar from your power source to the plating tank or too much resistance in the tank rheostat. These factors should be checked and improved, if necessary.

If your tank rheostat has too large a voltage drop, remove the coil from the last switch and replace with a strip of solid copper. When this last switch is then closed, you will have bypassed the rheostat altogether.

Stripping Nickel

Question: We thought that we saw an advertisement in your magazine by a company that stripped nickel from a zinc base diecast without pitting. We have been unable to locate this company and we are wondering if you could not give us some assistance and forward the name of the company to us.

K. S.

Answer: The advertiser was the Stratford Co., 207 Bay Street, Bridgeport 7, Conn.

Rating Electrical Conductors

Question: With reference to the article "Essentials of Plating Rack Design" by William E. Belke that appeared in "METAL FINISHING GUIDEBOOK-DIRECTORY," 1949 issue, we would like to know what is the basis to decide the maximum practical amperages for metals as we have used higher amperages than recommended with no apparent trouble.

One example is racks for iron covers where we use chrome plate, 500 amp. or higher per rack whose stem is square copper ⅜ x ⅜". We are interested in the information as we are going to make a large quantity of racks and we want to avoid any trouble with them.

T. R.

Answer: The determining factor in rating electrical conductors is voltage drop, heating-up effect or resistance which is the basic value. Ordinarily, in plating departments, a value of 1,000 amperes per square inch cross section area is employed, which will result in a negligible voltage drop over a distance of 25 ft. from machine to

plating unit. Since the resistance of copper decreases with decrease in temperature, cooling will permit higher current carrying capacities. Carrying this to extremes, it has been stated that, at absolute zero, the theoretical limit of temperature, a fine wire would carry millions of amperes because there would be no resistance.

Since the heat generated in a plating rack can be dissipated more readily through the plating solution than in air, a plating rack can be rated higher in carrying capacity than could busbar. Then again, the size of a rack would be a function of the generator voltage. For example, if you are employing a 6 volt machine and the plating process requires 5 volts for satisfactory operation, only one volt drop is permissable in the system. However, if an 8 volt machine is employed, a larger voltage drop in the system is permissable and busbars and racks of smaller cross sectional area can be used. Of course, we are ignoring the economics of investing more capital in equipment to save power lost in the system.

Coloring and Plating Stainless Steel

Question: We are manufacturers of name plates and would like to add to our line name plates in etched stainless steel. Could you let us know a process for black coloring stainless steel?

We would also be interested in a process for copper plating and nickel plating of stainless steel.

J. C.

Answer: A process for blackening stainless steel was patented by I. Clingan (U. S. Pat. 2,394,899, Feb. 12, 1946) and assigned to American Rolling Mill Co. The process, which is in use commercially, consists of immersion in a fused bath of dichromate, either sodium, potassium or their mixtures, at a temperature of 730-750 deg. F.

For plating on stainless steel, we would recommend the nickel chloride strike. This is a solution of 2 lbs. nickel chloride and 1 pint hydrochloric acid per gallon of solution. Nickel or carbon anodes are employed and the stainless steel is made the cathode at 6 volts for ¼ to 2 minutes. The treatment removes the surface film and deposits an adherent layer of nickel. The article can then be transferred to any plating solution for further deposition.

Silverdeposit Ware

Question: We are interested in anything relating to silverdeposit work and if you have any publications on this we would be interested in obtaining them.

G. M. T.

Answer: We do not have any publications on the subject of silverdeposit work. However, the Guidebook has a section on silver plating, including formulas and operating conditions.

Silver conducting paints for silverdeposit work can be obtained from Hanovia Chemical Co., Newark, N. J. and B. F. Drakenfeld in New York. These are fired in a muffle at a temperature just below the softening point of the glass and the articles are then wired or racked and plated in the usual manner.

Nickel-Cobalt-Phosphorus Deposits

Question: I am seeking information concerning the Bureau of Standards process of depositing nickel-cobalt-phosphorus alloy.

H. B.

Answer: The process of depositing nickel and cobalt-phosphorus alloys was published by A. Brenner, D. E. Couch and E. K. Williams in the Journal of Research, National Bureau of Standards, **44**, 109 (1950).

Anodizing

Question: What information can you give me on anodizing?

R. L.

Answer: Chapters on anodizing, both the sulfuric acid and the chromic acid processes, appear in the 1951 edition of the Metal Finishing Guidebook-Directory. The Guidebook also has a section on dyeing the anodized surfaces.

Patents

Recently Granted Patents in the Metal Finishing Field

Treatment of Waste Pickle Liquor

U. S. Patent 2,605,169. *July* 22, 1952. *W. Tiddy and F. D. Cooper, assignors to Allied Chemical & Dye Corp.*

A process for the treatment of waste pickle liquor containing about 10 to 30% ferrous sulfate and free sulfuric acid which comprises in a first stage treatment introducing a gaseous mixture of air and ammonia into waste liquor maintained at a temperature between 25° and 63° C. and a pressure of 15 to 60 pounds per square inch absolute until the pH of the waste liquor is within the range of 6.0 to 6.2, and in a second stage treatment increasing the temperature of the liquor to at least 90° C. and the pressure to from 60 to 105 pounds per square inch absolute, introducing air containing declining amounts of gaseous ammonia into the liquor while maintaining the pH of the liquor between 6.3 and 6.7, limiting the addition of ammonia gas to not in excess of stoichiometric requirements to react with ferrous sulfate, regulating the introduction of air and gaseous ammonia into the pickle liquor during said second stage treatment in accordance with changes in periodicaly determined concentrations of ferrous sulfate in the liquor to precipitate about 80 to 95% of the iron content in the pickle liquor, said precipitation of the iron content in the pickle liquor being maintained by said regulation of air and gaseous ammonia at a rate sufficient to maintain the value of K between 0.010 and 0.020 in the formula:

$$K = \frac{L}{180T} \log. \frac{A}{X}$$

wherein:

K is the velocity constant for the rate of precipitation;

L is the concentration of ferrous sulfate in grams per liter in the waste liquor at the start of precipitation;

T is the time in minutes during a period of precipitation; a period being the time between which two determinations of ferrous sulfate concentration are made:

A is the concentration of ferrous sulfate in grams per liter in the waste liquor at the beginning of said period; and

X is the concentration of ferrous sulfate in grams per liter at the end of said period;

and separating the precipitate, the total iron of which is predominantly in a ferric state, from the liquor.

Protecting Magnesium

U. S. Patent 2,605,217. *July* 29, 1952. *H. M. Freud*

A process of protecting a metallic object formed of magnesium-rich metal, which process comprises galvanically coating such an object, while serving as the anode in a galvanic cell in which the electrolyte consists essentially of an aqueous solution of a water soluble chromic acid salt of a metal selected from the group consisting of chromium, aluminum, and zinc, such process being conducted without applying any electric current from an outside source to said galvanic cell, and which solution is incapable of chemical action on magnesium metal, and which solution has a pH between about 2.5 and 3.5.

Wet Blast Cleaning

U. S. Patent 2,605,596. *August* 5, 1952. *W. C. Uhri*

The method of cleaning a surface which comprises discharging at high velocity, a thin, flat edgewise diverging jet of gaseous fluid into a stream of cleaning slurry which is moving in a direction substantially normal to the direction of movement of the gaseous fluid to cause substantial envelopment of said fluid by said slurry, immediately forming the mixture of gaseous fluid and slurry into a second thin, flat edgewise diverging jet, confining said second mixture jet for a sufficient time while simultaneously progressively decreasing the thickness thereof to permit substantial atomization of the same, and thereafter freeing the atomized mixture at high velocity against the surface to be cleaned.

Dipping Conveyor

U. S. Patent 2,605,882. *August* 5, 1952. *T. H. Curtis, assignor to Hanson-Van Winkle-Munning Co.*

In a processing machine having a frame and a plurality of work stations, a plurality of work members comprising workpiece supporting devices, a conveyor in the frame to move said members from station to station, an elevator for vertically reciprocating said members on the conveyor, said conveyor and elevator operating alternately so conveying takes place only while the elevator is up, a hold-out member on said frame at at least one work station adapted in its effective position to engage the work member at that station and to support it while the elevator goes down, said hold-out member also having an ineffective position, means urging said hold-out member toward its ineffective position, actuating means energizable for moving said hold-out member into its effective position, and means adjustably mounted on said work members for selectively energizing said actuating means in response to the movement of said members into said one work station and for de-energizing said actuating means in response to the movement of said work members out of said one work station.

Washing and Cleaning Gun

U. S. Patent 2,606,073. *August* 5, 1952. *W. C. Uhri*

A washing and cleaning gun for discharging a relatively thin flat fan-shaped stream of water and abrasive mixture comprising upper and lower housing members, a coaxial orifice and nozzle formed by said housing members and being disposed therebetween, the upper and lower walls of said nozzle being flat and gradually converging toward each other from one end of the nozzle to the opposite end thereof, a concave chamber disposed between said orifice and nozzle and formed in said upper housing member, means to supply fluid under pressure

to said orifice, and means to supply abrasive mixture under pressure to said chamber to cause substantially complete envelopment of said first named fluid by said abrasive mixture within said chamber prior to passage of said water and abrasive mixture into said nozzle.

Electrodeposition of Arsenic

U. S. Patent 2,606,147. *August* 5, 1952. *A. E. Chester, assignor to Poor & Co.*

In a method of controlling the electrodeposition of arsenic from a sodium arsenate plating bath onto an electrically conducting object of a type in which the arsenic would normally be deposited in greater concentrations in some areas than in others by a direct plating current; the step which comprises electrodepositing the arsenic by subjecting said object in a plating bath to a plating current having an asymmetric alternating wave form comprising an alternating current superimposed on a direct current in the ratio of 2 to 4 volts R. M. S. to 2.5 volts D. C., regardless of the specific current values, at current densities from about 2 to about 15 amperes per square foot.

Abrasive Polishing Wheel

U. S. Patent 2,608,804. *Sept. 2, 1952. H. M. Field*

An abrasive polishing element comprising a pair of elongated transversely folded abrasive strips interlaced together at right angles to each other, the length of the folded portion of each strip being substantially greater than the width of the strip whereby the pad formed by said strips will be of cruciform shape.

Abrasive Article

U. S. Patent 2,609,285. *Sept. 2, 1952. J. A. Thomas, Jr., assignor to The Carborundum Co.*

A metal-bonded abrasive article comprising a sintered abrasive portion containing a minor proportion of diamond abrasive particles and a bond comprising the sintered reaction product of a major proportion of copper powder and tin powder in an amount up to about 20% of the weight of said bond, and an integral, sintered, nonabrasive metal support for said abrasive portion comprising in sintered form about 50-70% iron powder, 24-40% copper powder and 6-10% tin powder.

Tumbling Machine

U. S. Patent 2,606,408. *Aug.* 12, 1952.
E. B. Banks and K. P. Tota

A tumbling machine including a cabinet of rectangular shape in cross section, a horizontal rotary shaft, means within the cabinet for supporting said shaft extending from front to rear of the cabinet at the upper part thereof with the main portion of the shaft within the cabinet and with one end portion thereof projecting a short distance forwardly of a side wall of the cabinet, an electric motor within the cabinet at the lower part thereof, a drive connection within the cabinet between the motor and said shaft, a vessel carrier of disc-like form mounted on said end portion of the shaft exteriorly of the cabinet, and a plurality of tumbling vessels, the vessel carrier having apertures therein for individually detachably securing the tumbling vessels on the vessel carrier.

Method and Apparatus for Removing Excess Galvanizing Metal from Conduit or the Like

U. S. Patent 2,606,846. *Aug.* 12, 1952.
W. S. Pearson, assignor to Clifton Conduit Co., Inc.

In a method of removing excess molten galvanizing metal from tubular freshly internally and externally galvanized articles, the steps of blowing the excess molten galvanizing material from the external surface of the article progressively from one end to the opposite end of the article, and while uninterruptedly continuing the external blowing at said opposite end sending a high pressure internal swabbing fluid blast into said one end for blowing the interior of the article clear of excess galvanizing metal to discharge through said opposite end of the article, whereby said external blowing at said opposite end prevents excess molten metal forcibly ejected by the internal blast from the interior of the article from whipping around onto the external surface of said opposite end of the article.

Method of Treating Tin Plate

U. S. Patent 2,606,866. *Aug.* 12, 1952.
R. A. Neish, assignor to U. S. Steel Co.

In a method of treating sheet material having a tin surface, to inhibit the tendency thereof to sulphide staining and baking discoloration and increase the adherence of lacquer, the steps including first making the ma-

terial cathode in an acid solution containing from .2 to 3% of a chromate of an alkali metal and having a pH value of from 2 to 7, thereby at least partially reducing the oxide film initially existing on the material, and immediately thereafter making the material anode while still in said solution, thereby re-oxidizing the tin surface and forming thereon a water-insoluble protective film of a complex combination of the oxide and said chromate.

Pickling Composition

U. S. Patent 2,606,873. *Aug.* 12, 1952. *P. H. Cardwell, L. H. Eilers and B. P. Robinson, assignors to The Dow Chemical Co.*

A composition for removing scale deposits from ferrous metal surfaces comprising an aqueous solution of hydrochloric acid containing by weight from about 1 to 30 per cent of HCl, from about 0.05 to 2 per cent of an organic nitrogen base selected from the group consisting of the aromatic and heterocyclic nitrogen bases, from about 0.002 to 2 per cent of HCHO, and from about 0.02 to 0.1 per cent of a wetting agent dispersible in the solution, said wetting agent being a compound of the group consisting of sulfated and sulfonated organic compounds.

Sprayed Metal Coating

U. S. Patent. 2,607,983. *August 26, 1952. B. V. McBride, assignor to Westinghouse Electric Corp.*

An article of manufacture comprising, in combination, a ferrous metal base member and a protective coating applied to the surface of the base member, the coating comprising essentially sprayed porous metal and a corrosion inhibiting compound selected from the group consisting of phosphate and chromium compounds embodied both on the exposed surfaces and in the body of the sprayed metal.

Protective Coatings

U. S. Patent 2,608,496. *August 26, 1952. B. S. Tuttle and G. E. Jacobs, assignors to J. N. Tuttle, Inc.*

A composition for use in treating chemically coated articles consisting essentially of a mixture of sodium aluminate and disodium phosphate in proportions between 1:3 and 1:1, by weight.

Recent Developments

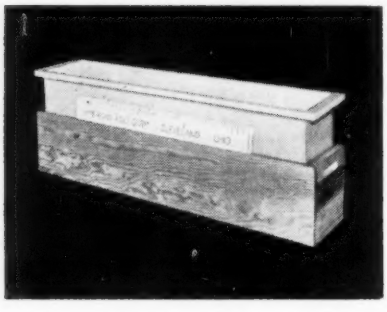
New Methods, Materials and Equipment for the Metal Finishing Industries

Corrosion-Resistant Tank Liners

American Agile Corporation, Dept. MF, P.O. Box 168, Bedford, O.

Corrosion resistant tank liners made of Agilene (Polyethylene) and Agilide (Unplasticized Polyvinyl Chloride) are now offered by this firm.

These tank liners, which are of fully



welded construction, are made to customer's specifications and can be furnished complete with drain and overflows, including pipe flanges, fittings and valves, permitting incorporation into existing pipe lines and installations.

The chemical inertness of these materials and the welding method employed in the fabrications of such tank liners guarantees a leak-proof liner and reduces maintenance and replacement costs of storage, make-up, and plating tanks containing corrosive liquids.

Tank liners of all sizes and shapes, with wall thicknesses up to 1", are fabricated at the company's plant in Maple Heights, Ohio, or on the site of final installation, depending on the complexity and size of the particular tank liner.

Pressure Cooled Buffs

United Buff Products Corp., Dept. MF, 233-241 Oak St., Passaic, N. J.

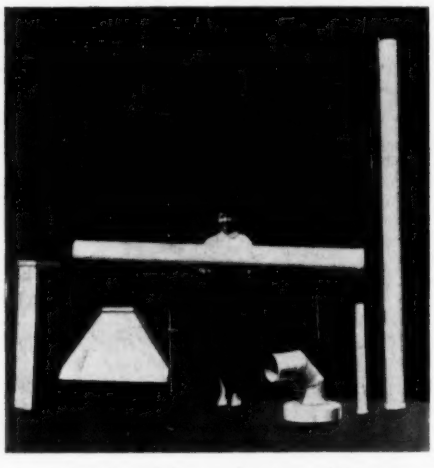
Now, for the first time, a "Pressure-Cooled" buff is available in sizes as low as 8" diameter. Made primarily for use in the silver and cutlery field on Clair, Porter-McLeod, Nicholas and similar equipment, the units are suitable for hand operations as well.

The "300" series "Pressure-Cooled" buffs are offered as a companion line to the "500" and "700" series which have proven their value in the electroplating industry. They are available in a variety of cloths and densities and feature a unit-type metal-center assembly. For further information contact your local distributor or United Buff Products Corporation, Passaic, N. J., sole patentees and manufacturers.

Corrosion Proof Equipment

Heil Process Equipment Corp., Dept. MF, 12901 Elmwood Ave., Cleveland, O.

This firm announces the availability of a complete line of solid plastic corrosion-proof fume ducts, hoods and accessory equipment. General construc-



tion is offered by polyester glass combinations as well as Rigivin, rigid vinyl type, and Rigidene, polyethylene type.

Rigidon, the glass reinforced polyester resin combination, possesses the strength of light metals and is much lighter in weight. Good acid resistance outside as well as inside reduces maintenance cost and the possibility of mechanical damage. This plastic material will withstand operating temperatures in excess of 200° F. and is easy to install because of its lightweight construction and simple method of field joints.

Units are standardized in both round and rectangular duct sections and hood designs and manufactured in accordance with the latest recommendations for ventilating open process tanks by the American Standards Association. Available designs, standard sizes, and complete prices may be obtained by writing Heil Process Equipment Corp. for Bulletins 751 and 754.

Electropolishing Solutions

The Globe Chemical Co., Inc., Dept. MF, Cincinnati 17, O.

This company is now able to supply several of the solutions used in The Battelle Electropolishing and Chemical Polishing Processes mixed in the proper proportions and in the ready to use condition. These are supplied in 13 gallon returnable carboys and authorization to use the processes is included with the purchase of the solutions. Complete instructions for the operation of the processes are included with such purchase. These solutions include those for carbon and stainless steels, copper, brass, aluminum, Monel and nickel silver.

Versatile Polishing Head

Murray Way Corp., Dept. MF, Maple Rd., Birmingham, Mich.

Developed for today's highly technical and specialized uses, this new head may be converted by a few simple adjustments to a wide range of usefulness in any plant.

The new head was developed espe-

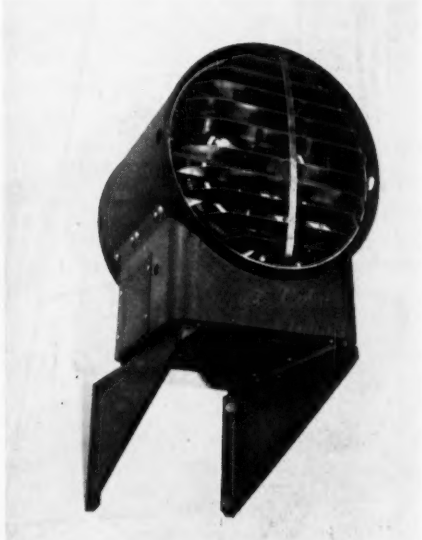
cially for the fast, accurate and economical deburring of turbine disc-slots and incorporates several of the Murray-Way universal-positioning features. The head may be used with either wheels or buffs and is exceptionally compact in design, making its use in groupings practical with a minimum of floor area.

In the turbine disc-slot operation two, three or four heads are used as the work requires. Heads may be dropped or added easily if found necessary. Because of its compactness and easy-positioning features the new head will be manufactured as a moderately priced, standard item in the Murray-Way line of automatic polishing and buffing equipment.

Further information available on request to the above manufacturer.

Electric Unit Heater

Edwin L. Wiegand Co., Dept. MF, 7627 Thomas Blvd., Pittsburgh 8, Pa.



The Chromalox UB series of blower-type electric unit heaters now includes a large 20 KW. model. The new heater, like older 2 to 17 KW. models, is suitable for floor, wall or ceiling mounting.

Used in every trade and industry, Chromalox electric unit heaters either provide the basic heat source for an office or factory, or supplement the central heating system. In the latter case, they provide efficient, controlled warmth in the Spring and Fall when it is not practical to use the central system. Easily spotted in any location, they overcome drafts in stairways or other hard-to-heat areas. They are also used where precise temperature control is important for production, storage, curing, etc.

The UB heater consists of a heavy-gauge, sheet metal case with durable, brown wrinkle finish, one or more Chromalox Koilfin strip elements sheathed with steel for safety, and a fractional horsepower motor blower. Adjustable aluminum louvers can be tilted to deflect the warm air stream up or down about 20 degrees. A thermal cutout guards against overheating.

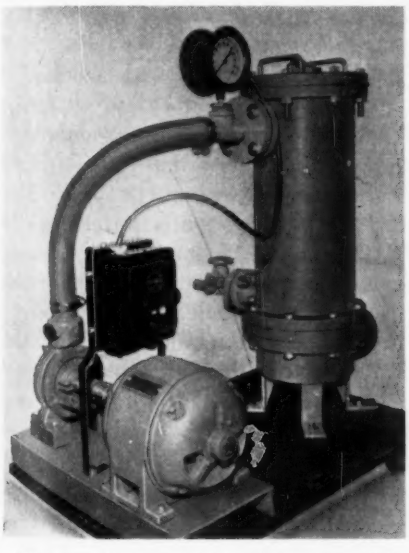
Most UB heaters operate on either 230 or 460 volts single or three phase. Overall dimensions of the 20 KW. size are approximately 17 x 21 x 21 inches. Net weight of this size is 79 pounds.

For more information about unit heaters, write to the above address.

Sethco RLS Series Filter Pumps

Sethco, Dept. MF, 70-78 Willoughby St., Brooklyn 1, N. Y.

This firm announces its most recent addition to its line of corrosion resistant filtering equipment, namely its RLS Series.



This series consists of two models, Models RLS-1200 and RLS-2400. Both of these filter pumps are designed and constructed to produce sparkling clear filtration of practically any acid or alkaline solution from pH 1 to pH 14.

The former is rated at 1000 to 1500 gallons per hour and the latter is rated at 2000 to 2500 gallons per hour for filtering.

Two recent Sethco developments are now incorporated in these pumps, namely self-priming turbine pumps and automatic controls which include magnetic starter, stainless steel pressure switch and stainless bourdon gage. Set up is such that motor stops automatically when the filter assembly becomes loaded with impurities.

In addition, other outstanding fea-

tures of the RLS Filter Pumps are:

1. Filtering capacity 1000-2500 gallons per hour.
2. Pump and all fittings fabricated of stainless steel type 316 (most corrosion resistant stainless).
3. Filter assembly rubber lined.
4. Drip proof 220-440 V, 3 phase motors of proper rating to give flow rates noted above.
5. Heavy polished bakelite base 1" thick used for mounting the equipment.
6. Base equipped with heavy ball bearing, rubber covered casters for easy portability.
7. Each unit furnished complete with 15 foot inlet and outlet chemical hose.
8. Extremely simple operation.

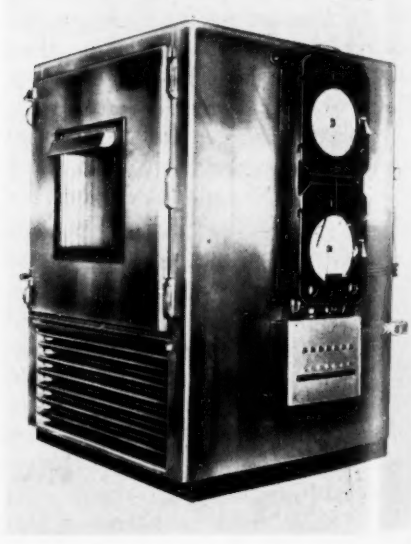
For additional information and prices write to the manufacturer.

Temperature-Humidity Test Chambers

Tenney Engineering, Inc., Dept. MF, 26 Avenue B, Newark 5, N. J.

To supply industry with a standard line of environmental test chambers for conducting temperature-humidity tests, the company has standardized on five basic chamber types This standardization permits purchasers to select chambers from existing specifications and eliminates the extra cost of custom built models These chambers automatically maintain humidity from 20% to 95% through a temperature range of 35°F. to 185°F. Minimum dew point is 33°F.

The chambers, known as the Tenney TH Series, comes with the following inside dimensions: (1) 22" x 19" x 48", (2) 42" x 18" x 48", (3) 36"



x 3[illegible]" x 36", (4) 42" x 24" x 48", and 48" x 24" x 48". Models 1 and 3 have one door; the others have two. Common to all models are accurately calibrated indicating thermostatic controllers, air circulating blowers for uniform movement of air, and stainless steel interior and exterior paneling.

Four types of controls are incorporated in the Tenney TH Chambers—constant humidity, constant temperature; constant humidity, varying temperature; varying humidity, constant temperature; and varying humidity and varying temperature.

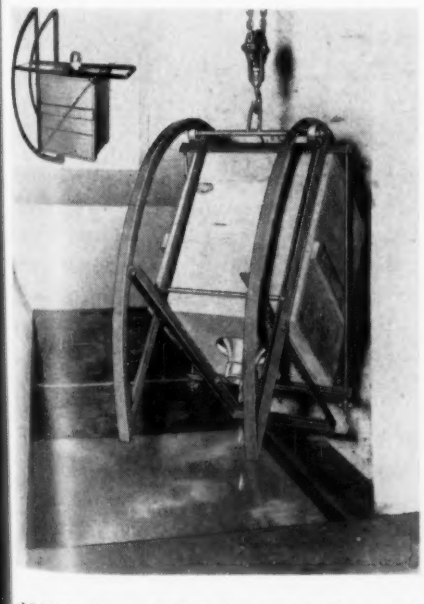
The chambers meet over 20 schedules to which government agencies and manufacturers of government equipment must conform.

For additional information on the chambers write the above company.

Carboy Rocker

Morse Mfg. Co., Dept. MF, Syracuse, N. Y.

Getting the last drop from a carboy, safely and efficiently, is now made possible by the new Morse carboy rocker with emptying attachment. The company states that the attachment allows the carboy rocker to hang from a chain hoist or crane over the vat until emptied. The attachment, with two wheels which run on the rocker parts, has a lock hook which holds the carboy rocker in the upside-down position. Simple leverage will right the carboy rocker. Morse carboy rockers are equipped with wheels to serve as combination trucks and rockers, and will handle conventional size acid carboys from 18x18x23 to 20x20x25. Adjustable steel rods connect the angle steel braces to tighten their grip on the car-



boy. The rods also serve to brace the sides of the carboy without being fastened to the wood itself. The new emptying attachment will fit all Morse carboy rockers and may be had with or without new carboy rockers.

Floor Resurfacer

Flexrock Company, Dept. MF, 3665 Cuthbert St., Philadelphia 4, Pa.

Dangerous, worn floors can be given a smooth jointless surface with this practical, economical resurfacer, developed to withstand the heaviest industrial use. Combines the durability of concrete and the flexibility of wood. A ½" topping of this material provides a new surface. Manufacturer says that Flexrock is non-dusting and fire-resisting. Withstands vibration and will not splinter, warp or crack. Also, withstands heavy abrasive traffic and any weight the substructure will bear. The resurfacer is stated to be warm and easy on the feet. It comes in one complete unit, no other materials to buy. Application is easy and floor is ready for use overnight. There are five colors plus natural to choose from.

All-Metal Floating Thermometer

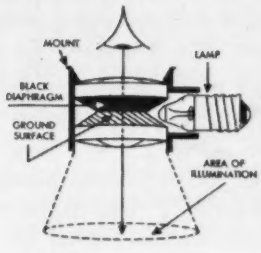
Weston Electrical Instrument Corp., Dept. MF, 617 Frelinghuysen Ave., Newark, N. J.

A new all-metal floating thermometer of the easy reading dial type, which can be accurately read without removing from the tank has just been marketed by the company. Originally designed for use in the dairy industry for the processing of cheese, it is finding application in many fields where it is desirable to have a constant check on liquids during processing.

The thermometer is constructed of stainless steel and is equipped with an unbreakable window. Its streamline design makes cleaning easy and eliminates the possibility of product contamination. The scale has bold, legible markings to permit quick readings while the thermometer floats. The accuracy is ±1°F. over the entire scale. It is regularly supplied with a range of 50° to 150°F., and stem length of 5", although other ranges and special types can be provided. Complete details can be secured direct from the manufacturer.

10-Power Magnifier with Built-in Light Source

Bausch & Lomb Optical Co., Dept. MF, Rochester, N. Y.



A new, inexpensive, 10-power magnifier that can be clipped to the pocket like a fountain pen, and which uses two penlight batteries and bulb for illuminating the object, is designed for on-the-job inspection of small parts, castings, small joints and welds, reading micrometer and other fine scales, and similar shop and laboratory uses.

Weighing only two and one-half ounces, including batteries, the magnifier employs a unique lens construction which allows the light from the bulb to go directly through the lens and onto the object, without any direct light reaching the user's eye. Because a 10-power magnifier is most effectively used when held directly to the eye and less than an inch from the object, built-in illumination is highly desirable in order to observe the fine detail for which the magnifier is used. The lens system is the Bausch & Lomb Coddington, used in a black tenite mount with chrome-plated handle. The instrument retails for $7.50.

Wire Cup Brush

Hewitt-Robins Inc., Dept. MF, Buffalo 5, N. Y.

A new wire cup brush with replaceable filler has been developed by the above firm for the removal of rust, scale, paint and welding slag from railroad equipment, tanks, gears and other metal surfaces.

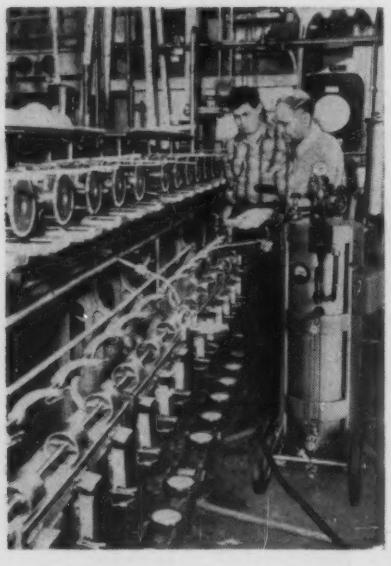
The brush, an addition to the company's Rubberlokt line, consists of inner and outer metal adapters with a replaceable cup-shaped filler in which the wire bristles are anchored in place with rubber.

The new brush is expected to be more economical because the metal adapters need be purchased only once. The cup shaped filler can be replaced a limitless number of times. The brush also features improved balance, shock absorption and bristle retention. It will be available in wire gauges ranging from .014" to .028".

Steam Cleaning Machine

Livingstone Engineering Co., Dept. MF, Worcester, Mass.

This company announces important design changes and improvements in the Speedylectric Steam-Jet Cleaner



JC-10, the smallest portable unit of the line. Higher operating pressures (to 150-p.s.i.) and closer finger-tip control of steam-detergent mixtures make the JC-10 a remarkably effective tool for light duty cleaning. Requiring only 26″ x 17″ floor space, it can be maneuvered through the narrowest aisles. It weighs less than 200 pounds and is equipped with 10″ rubber-tired wheels to provide maximum portability. Unlike fuel fired "steam" cleaning machines which depend on hot water and large quantities of solvents under pressure for their cleaning action, the JC-10 uses steam from the built-in high pressure Speedylectric boiler. Small quantities of solvents are used effectively and economically for they are not diluted by mixing with gallons of water at the jet. Dirt, grease, oil and caked-on accumulations literally melt away before the high velocity jet of hot dry steam and solvents applied instantly as needed under push button control of the operator. There is no flooding of the working area, no smoke, flames or fire hazard. Furthermore, the unit is completely free of low water danger. The boiler water itself is the electric resistance heating element and if there is no water, no current passes and no steam is generated. The boiler is the Model 500-S3 built under ASME Code, carries National Board stamp, and is Underwriters' Laboratories listed. The JC-10 is available for single or polyphase power supply of 220, 440 or 550 volts, AC current.

Cleaner for Aluminum and Tin

Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

Oakite Products, Inc. have announced the development of Oakite Composition No. 80-A, a material designed for use wherever an excellent cleaner offering a high degree of safety to aluminum, tin or other soft metals is required.

Oakite Composition No. 80-A, the manufacturers state, has wide applications on a broad variety of work in aircraft and metal plants where exceptional cleaning ability and thorough safety in use are essential. Material may be used in soak tanks or pressure spray washing machines, is readily soluble in hot water, rinses easily with hot or cold water. It does not exhibit any tendency to foam excessively, it is claimed.

Additional information regarding this material, plus helpful data on preparation of solutions, recommended concentrations, methods of application, etc., will be sent without charge to readers writing on company letterhead.

D-C Current-Measuring Reactor

General Electric Co., Dept. MF, Schenectady 5, N. Y.

A d-c current measuring reactor which safely measures d-c current up to 120,000 amperes has been announced by the Co. Normal accuracy is plus-or-minus two per cent, and customer specified accuracies of one or one-half per cent are also available.

In standard models of 1,000, 3,000, 5,000, 8,000 and 10,000 amperes, the new reactor is available up to 120,000 amperes on special order. It is de-

signed for users of large amounts of d-c power such as the electro-chemical, steel and aluminum industries.

The main feature of the new device is that it isolates the control leads from the current being measured. In the conventional shunt method of measuring current, the shunt leads are at the d-c potential. With the current-measuring reactor, instrument leads are energized at low a-c voltage, usually 120 volts, 60 cycles, reducing shock hazard materially at the control panel. The leads to the instrument need not be calibrated and can be any reasonable length. Thus, control leads are not specified in advance, and can be cut to size at the time of installation. If additional instruments are desired they may be added to the secondary circuit with greater ease than is possible with the shunt system.

The new device slips in place over the d-c bus and does not require that the bus be broken or that bolted connections be made at the point of measurement. Another advantage is that the reactor uses only a small amount of power from an a-c source. The cores are enclosed in a molded shell made of glass-reinforced polyester resin.

Pressure Regulator and Filter

Minneapolis - Honeywell Regulator Co., Industrial Division, Dept. MF, Wayne & Windrim Aves., Philadelphia 44, Pa.

A combination pressure regulator and filter has been added to its line of standard products by the Industrial Division of the company. The new device provides a single, compact unit that contains the functions of a dependable reducing-relief valve and a filtering arrangement for line service. Line pressures up to 150 pounds a square inch can be reduced and maintained at any regulated output pressure from 0 to 35 p.s.i. without appreciable drift or air consumption. In addition, the filter and dripwell, accessible for easy removal and servicing, assure a constantly clean supply of air for pneumatically-operated instruments and similar equipment.

Floor Patch Dries Almost Instantly

United Laboratories, Inc., Dept. MF, 16801 Euclid Ave., Cleveland 12, O.

An improved, high-speed method to repair holes, ruts and other imperfections in concrete floors of all kinds is announced by United Laboratories. This new product, known as Superset Tampatch, is highly applicable throughout industry and institutions wherever the need lies to repair floors without loss of productive time. Essentially, all that is needed is to clean and bond the surface to be patched, dump in the required material and tamp firmly into place. The patched area may be placed in service almost instantly. The patch becomes smooth with moving traffic and will withstand extremely heavy loads. Superset Tampatch is composed of specially prepared aggregates coated with fast drying synthetic resins and combined with asphaltic oils. The material is shipped in drums of various sizes, ready to use without mixing. When the container is kept air tight, the material will keep indefinitely and is ready for use at any time. The bonding material is delivered separately

and is also available in various size containers.

Further information may be obtained by writing the manufacturer.

Photoelectric Smoke Indicator

Combustion Control Corp., Dept. MF, 720 Beacon St., Boston 15, Mass.

To assure plant engineers that their plant smoke conditions are within the legal limits established by municipal ordinances and to provide a simple and direct method of maintaining a continuous check on overall combustion efficiency, this firm offers Fireye Photoelectric Smoke Indicator Series FE. Fireye Series FE continuously indicates the density of smoke passing through the stack of a power plant and signals when the smoke density exceeds a preset value.

Fireye Smoke Indicators consist of three basic units: a Light Source, a Photoelectric Scanner, and a Control and Indicator combined in a single housing. The Light Source and Scanner are mounted on opposite sides of the stack or breeching and the indicator is placed at any convenient location, such as on the control panel. As smoke in the breeching passes through the light beam, the indicator shows a smoke density reading which can be easily read on the large 4½ inch indicator scale in both Ringelmann numbers and per cent of smoke density. Red and green jewel lights provide visual indications of excessive or efficient smoke conditions.

Series FE Smoke Indicators are fully described in Bulletin CM506.

All-Plastic Spectacle-Type Eye Shield

Bausch & Lomb Optical Co., Dept. MF, Rochester, N. Y.

Weighing only one and one-quarter ounces, an all-plastic eye shield that provides low-cost eye protection in semi-hazardous operations has been developed by the above firm.

Shown on model above, it has a flexible, one-piece curved acetate lens which can be replaced in seconds by bending and snapping it in or out of place. Called BAL-spec, the shield can also be worn over regular or corrective safety glasses to prevent lens pitting and scratching. Available in crystal clear or green acetate for glare protection, lens conforms to United States Bureau of Standards requirements.

High Pressure Blower

Standard Electric Mfg. Co., Inc., Dept. MF, West Berlin 12, N. J.

A high pressure blower that quickly removes fumes, smoke, dust, sawdust and obnoxious odors is being offered by the above company.

The precision made, all-aluminum,

high quality blower moves up to 450 cubic feet of air per minute. On the standard unit, made with a 5½" inlet and 3½" outlet, power is supplied by an enclosed, 1/6 h.p., Westinghouse, 115 v, single phase AC, 3,450 r.p.m. motor. However, larger sizes with different speeds and different current characteristics can be obtained.

Motor Driven Acid Pump

General Scientific Equipment Co., Dept. MF, 2700 W. Huntingdon St., Philadelphia 32, Pa.

This new pump has been designed for those requiring a faster flow of acid and other liquids, and for those who in some cases must elevate the flow to a height of 12 feet.

The pump is self contained, portable,

compressor is electric motor driven, fully equipped with safety air valves which prevents the pressure from exceeding 15 lbs.

As regularly supplied this pump will fit all standard carboys, but special plugs and adapters are required to fit some stainless steel, aluminum, and plastic containers.

Price of the complete unit is $94.50.

Combination Truck and Drain Rack Loads Automatically

Palmer-Shile Co., Dept. MF, 16035 Fullerton, Detroit 27, Michigan.

A combination truck and drain rack that is designed for industrial users of solvents, cutting oils and detergents, is announced which can be easily move through crowded, narrow aisles and around heavy machinery.

To load just tilt truck against drum, sliding steel fingers down to engage top rim of drum; then rock truck back to wheeling position, and loading is automatic. Slight downward push on truck handles raises wheels and lays rack on floor, thus providing conveni-

ent drain of drum. Equipped with detachable handles that may be removed to conserve floor space—one pair will serve any number of trucks.

All welded construction of heavy angle iron frame with sturdy steel tubing for handles. Two eight-inch roller bearing wheels. Weight approximately 90 lbs.

Fire Protective Transfer Pump

Protectoseal Company, Dept. MF, 1920 So. Western Ave., Chicago 8, Ill.

Designed for complete safety from the bottom of the suction tube to the top of the discharge nozzle, the new Protectoseal Transfer Pump is claimed to provide effective protection against explosion and fire hazards in the movement of hazardous liquids from receiving drums to use containers.

Three flame arrestors are built into the pump and are an integral part of it. These are placed at the exact points necessary to prevent an explosion of vapors,—at the spout, above the bung adaptor and at the strainer inlet within the drum. In addition, the pump provides for vent and pressure relief through protected openings. Every detail of design and construction has been engineered to secure complete safety for the operator as well as the building in which the transfer is made.

The pump is self-priming and is constructed of special aluminum alloy with a brass telescopic tube for strength, durability, light weight and resistance to corrosion. It is quickly and easily attached to the drum by hand swivel

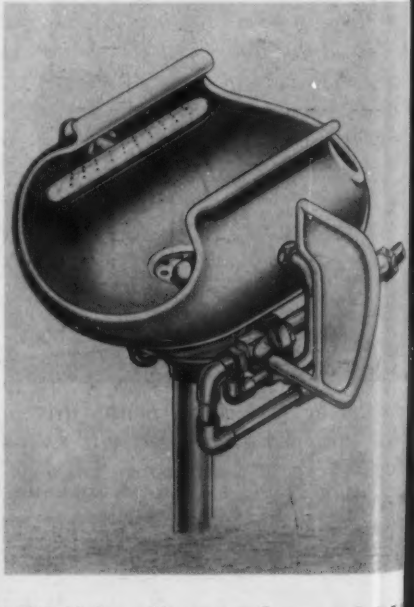
grip connectors and the telescopic tube permits pumping from either the side or end opening of 30 gallon or 55 gallon drums. Pumping speed is 5 gallons per minute,—fast enough for filling small containers, yet sufficiently slow to prevent sudden overflows. It is supplied complete with spout containing threaded hose connection, bung adaptor and telescopic suction tube. Tested and Approved by Underwriters' Laboratories, Inc., and Associated Factory Mutual Fire Insurance Companies.

Eye Wash Fountain

Logan Emergency Showers, Inc., Dept. MF, Box 111, Glendale, Calif.

To meet the demand for an eye-wash fountain that would instantly wet all parts of the face but without danger of recontamination, the Logan eye, nose and mouth wash fountain has been designed, embodying entirely new principles of spraying.

With the knowledge gained from exhaustive research, that immediate



thorough wetting of the face may save precious eyesight, or prevent disfiguration caused by acids, explosions, fumes, heat, chemicals, fire, etc., the Logan fountain is designed to gently spray a large volume of water at what amounts to neutral pressure.

BUSINESS ITEMS

Du Pont Transfers

Robert T. K'Burg has been transferred to the Detroit district sales office of the *Du Pont Company's Electrochemicals Department* as technical representative in the field of chlorinated solvents, it was announced recently by *Morell Marean*, district manager.

At the same time Mr. Marean announced that *Rodney T. Taylor, Jr.*, has been assigned as technical representative for vinyl products in the Detroit district, which includes the State of Michigan. Mr. Taylor also calls on trade in the Cleveland district.

Mr. K'Burg, until now technical assistant in chlorine products sales in the Wilmington, Del., office, joined the company in 1935 as a chemist at the Niagara Falls, N. Y., laboratory following his graduation from Ohio University with a B.S. degree in chemistry. He went to Wilmington in 1948 as technical service representative for solvents.

Mr. Taylor went to Cleveland earlier this year from the Niagara Falls plant where he was first employed in 1949 as a chemical engineer. He is a graduate of Yale University with the degree of bachelor of chemical engineering.

Sipi Metals Corp. Appoints Maury E. Lippert

Appointment of *Maury E. Lippert* as general sales manager is announced by *Sipi Metals Corp.*, Chicago smelters of non-ferrous alloys and warehouse distributors of Reynolds aluminum ingot.

Mr. Lippert, with the Sipi organization for the past 14 years, has been active in metal sales for 33 years. His background in the smelting industry particularly qualifies him to coordinate the activities of the company's salesmen and distributors. Mr. Lippert has devoted a considerable portion of his time in the promotion of brass ingot and white metal sales, as well as the bearing metal field, and is responsible for several refinements the organization has developed in non-ferrous distribution.

Kirchartz Forms New Firm

Paul E. Kirchartz, formerly eastern manager of the *Almco Division, Queen Stove Works*, Albert Lea, Minn., announces the formation of his own company, *Metal Finish, Inc.*, 410 Frelinghuysen Ave., Newark 5, N. J. for the purpose of engaging in all phases of work in the precision metal finishing field.

His many years of experience in this work, covering not only the sale of chips and compounds, but also the manufacture and distribution of all types of deburring and finishing equipment, qualify him to offer a most efficient service.

Catalogs and price lists on equipment and materials are now ready for distribution and will be sent upon request. Engineering assistance is also available free of charge.

Hooker Electrochemical Appointments

Hooker Electrochemical Co. announces that *Alexander D. Kischitz* has been placed in charge of research technical literature, and that *Jerome Wilkenfeld* has been appointed supervisor of process study. Both men have been associated with the company since 1943.

Mr. Kischitz is a graduate chemist from the University of New Hampshire, and prior to his recent transfer, he had been a research chemist. He is

a member of the American Chemical Society.

Mr. Wilkenfeld was graduated from City College of New York as a chemical engineer. He has been employed in various departments, being transferred to the process study group in 1945. Prior to his recent promotion he has been a group leader. Mr. Wilkenfeld is a member of the American Institute of Chemical Engineers.

Cowles Elects New Secretary-Treasurer

William M .Clossey has been elected secretary and treasurer by the board of directors of *Cowles Chemical Co.*, Cleveland, O.

Mr. Clossey was secretary and treasurer of *Broadhead Garrett Co.* in Cleveland just prior to joining Cowles and before that was a supervising accountant for Ernst & Ernst. He is a member of the Ohio Society of Certified Public Accountants.

Clossey and his wife, Josephine, and five children live at 2929 Edgehill Rd., Cleveland Heights.

William M. Clossey

Enthone, Inc. Announces New Sales Engineer

Joe Hauser Shockcor

Enthone, Inc. New Haven, Conn. manufacturers of chemical products and processes for finishing of metals have announced the appointment of a new sales engineer, *Mr. Joe Hauser Shockcor*. Mr. Shockcor is a native of Pennsylvania and received his B.S. in Chemical Engineering from Lehigh University in 1950. He was employed in the research laboratories of Enthone, Inc. for two years. He will service Enthone products in eastern Pennsylvania, Maryland, Delaware, Washington, D. C., parts of Virginia and Tennessee.

Udylite Opens Philadelphia Warehouse

The *Udylite Corp.* has announced the opening of its new warehouse in Philadelphia. This newest addition to the Udylite sales network handles a complete line of products and chemicals.

The warehouse has approximately 10,000 sq. feet of floor space to facilitate service and assure complete stocks. It is located at 2818 Belgrade. The telephone number is GArfield 6-5193.

One of the features of this facility is the drive-in and pick-up service which saves time for customers.

Dearth Joins Udylite

Raymond Dearth has joined *The Udylite Corp.* as sales engineer for the Northern Indiana area.

Before joining Udylite, Mr. Dearth, a chemical engineer, was with the *Anderson Company*, Gary, Ind., as a rubber technician and metal finishing engineer. He spent five and one half years in the U. S. Army during World War II. Prior to his Army service, he was associated with both the *U. S. Rubber Co.* and the *Firestone Tire and Rubber Co.*

Raymond Dearth

Hooker Announces Personnel Changes

R. E. Wilkin, general sales manager, *Hooker Electrochemical Co.*, announces the appointment of *William L. Gillespie* as field salesman for Chicago and the Midwest area. Mr. Gillespie has been with the Hooker Company since 1939, having been in the development and research department in various capacities until 1950. Prior to his recent transfer, he had been in the sales department on technical service.

At the same time *Harold Wever* was transferred to technical sales service. Mr. Wever has been at Hooker since 1943 and had been in the development and research department of the company prior to his recent transfer. He is a member of the Electrochemical Society and of the American Chemical Society.

Hopkins Named General Sales Mgr. of Bart-Messing Corp.

William A. Hopkins has recently been named general sales manager of *Bart-Messing Corp.* of Belleville, N. J.

Since 1934 Mr. Hopkins has been identified with many phases of the electroplating industry. After studying metallurgical engineering at University of Cincinnati, he was employed as a plating engineer with the *Electric Auto-Lite Co.* at their various divisions until 1945. During World War II he was associated with *Kellex Corp.* in work on the *Manhattan Project.* After 1945 he was associated with *Continental Die Casting Corp.* as plant manager, *Gerity-Michigan Corp.* as technical director and, until recently, *The McGean Chemical Co.* as Detroit-area sales manager.

William A. Hopkins

Carborundum Appoints Scott

Mr. Fred W. Scott, Jr. has been appointed manager of the newly established Merchandising Sales Division of *The Carborundum Company*, it was

announced recently by *F. J. Tone, Jr.*, vice-president, sales.

Formerly manager of sales for the Coated Products Division, Scott, in his new capacity will direct all functions of the new Merchandising Sales Division, including personnel, inventories, advertising and promotion, and sales. He will report to Vice-President, W. H. Wendel.

A nation-wide field sales organization which is also under the direction of Mr. Scott, has been established. with district offices located in Bristol, Pa.; Niagara Falls, N. Y.; Chicago; Chamblee, Ga.; Los Angeles and San Francisco.

Mr. Scott has been with The Carborundum Company since 1938, when he joined the sales division as a sales trainee. He has since served as sales engineer, industrial salesman in the Detroit area, assistant sales manager of the Coated Products Div., and as sales manager of that division.

A native of Niagara Falls, Mr. Scott attended the public schools there, and graduated from the Niagara Falls High School. He continued his education at Cornell University at Ithaca, N. Y. and graduated from the Engineering College in 1934. He now lives with his wife and four children at 962 Rankine Road.

Mirantz Rejoins Special Chemicals

Mr. Matthew S. Mirantz has rejoined *Special Chemicals Corp.*, 30 Irving Place, New York 3, N. Y. as assistant to the president. In his association with the firm prior to his just

Matthew S. Mirantz

completed 16 month tour of active duty as a Naval Reservist, Mr. Mirantz was in the production dept.

A graduate of Cornell University, class of 1949, he spent three years at sea during World War II in all theaters of operations. In his new capacity, he will concentrate his efforts in sales and sales promotion.

U. S. Rubber Appoints Willard

Henry W. Willard has been appointed factory manager of *United States Rubber Co.'s* Passaic, N. J. plant, succeeding *William C. Bowker*, who retired September 30.

Mr. Willard, 41 years old, started with United States Rubber Co. in 1929. working as an office boy during summer vacation. In 1934 he began as a time clerk in the Passaic plant, and since then has held a wide variety of positions. He was promoted to the office of general superintendent on May 19, 1950, and assistant factory manager on January 2 of this year.

He is a graduate of Cornell University and, while with the United States Air Force, attained the rank of lieutenant colonel on active duty in the Southwest Pacific theater.

Mardorf Joins Bullard Clark Co.

Ed Mardorf of 27401 Markbarry Drive, Euclid 23, Ohio, has just joined *The Bullard Clark Co.* of Danielson, Conn. and Charlotte, North Carolina as Sales Engineer.

Mr. Mardorf, formerly President of the *Elson Abrasives Corp.*, Cleveland, and a life-long resident of the Cleveland area, will devote his time primar-

Ed Mardorf

ily to the sale and distribution in Ohio of buffing and polishing wheels manufactured by the Williamsville Buff Division of the above-named company.

Wheelabrator Appoints New Assistant Technical Director

George W. Roper has been promoted to the position of assistant technical director of the dust and fume control division, at *American Wheelabrator & Equipment Corp.*, Mishawaka, Ind., according to an announcement made by *L. L. Andrus*, vice-president. Roper has been with the company for 6½ years, first as a sales engineer, and most recently as a project engineer.

Ronson Enters Aircraft Accessory Parts Field

To fulfill an increasing number of sub-contracts for aircraft accessories, *Ronson Art Metal Works, Inc.*, of Newark, N. J., manufacturers of the world-famous Ronson lighters, has equipped a new and additional plant. The new plant is a one-story building located at North 13th St. and Park Ave., Newark. It comprises 32,000 square feet of floor space. A railroad siding adjoins the rear of the new structure.

The company is currently fulfilling contracts with such firms as General Motors, Servel, Wright Aeronautical, Republic Aviation, RCA, and Westinghouse.

With a view to expanding this program for both defense work and special products for civilian use as well as military application, a separate staff for production, engineering, and purchasing activities is provided. As a result, the special products division of Ronson will be an integral organization, complete in itself.

Bridgeport Brass Opens New Philadelphia Warehouse

Because of the increasing demand for brass and copper mill products caused by industrial expansion in the middle Atlantic area, the *Bridgeport Brass Co.* of Pennsylvania has opened a new warehouse in Philadelphia at 918 East Lycoming St. The sales and operations will be in charge of *David F. Snow*, their district sales manager.

Hulse Appointed by Bicknell Associates

Thorman R. Hulse, formerly in research and development, *General Electric Company*, has been appointed Production Manager of *Alfred Bicknell Associates, Inc.*, Cambridge, Mass., manufacturers of scientific apparatus. Mr. Hulse will assist *Dr. Frederick G. Keyes*, Director of Research, in new instrument production planning.

United Chromium Adds Sales Engineer

Patrick A. Cavuto, formerly in charge of the electroplating department of *Muzak Corp.*, has joined the sales and service department of the electroplating division of *United Chromium, Inc.* Mr. Cavuto recently completed a comprehensive training course at the Detroit laboratories of United Chromium. He is now selling and servicing the complete line of Unichrome plating processes, materials, and equipment in the New York City area.

Patrick A. Cavuto

Before World War II Mr. Cavuto, who attended the University of Rochester, was employed as assistant purchasing agent for the *Will Corporation*, dealers in laboratory apparatus and supplies. During the war, he served in England with an Air Force fighter group.

National Research Corp. Appoints Keller

Robert A. Stauffer, vice-president in charge of research at the *National Research Corporation*, announced the appointment of *Wayne H. Keller* as director of the Chemistry Department.

Dr. Keller, a native of Kentucky, did his undergraduate work at Georgetown College, Georgetown, Ky., and graduate work at the University of Kentucky and Cornell University. He received his Ph.D. in physical chemistry from Cornell in 1937. During the years between 1927 and 1942, he taught inorganic and analytical chemistry at the University of Kentucky, as well as inorganic and physical chemistry at Morehead State Teachers College, Morehead, Kentucky.

Dr. Keller joined the uranium project at Iowa State College, Ames, Iowa, in 1942, where he was director of

chemical metallurgy for the Manhattan District program. He was one of the co-developers of the process by which uranium is made and also contributed to the development of making other metals necessary to atomic energy projects. In 1945 he joined the staff of the Mallinckrodt Chemical Works, St. Louis, Missouri, as assistant technical director on the uranium project.

Dr. Keller is a member of the American Chemical Society, the American Society for Metals, and the National Association of Corrosion Engineers. His publications include contributions to the fields of colloidal chemistry, the energy states of crystalline solids at low temperatures, the production of rare earth metals, as well as numerous classified reports in the chemical metallurgy of uranium and other metals. His work has also been concerned with the fabrication and firing of ceramic bodies.

Felix W. Saco Joins Permutit

The Permutit Co., New York, N. Y., manufacturer of ion exchange resins and water conditioning apparatus, announces the addition of *Felix W. Saco* to its mechanical engineering department.

Mr. Saco, appointed to the position of Mechanical Development Engineer, has been assigned to work on the design of all applications of ion exchange materials and techniques in the treatment of water and other liquids.

He attended New York University, receiving a Bachelor's degree in Mechanical Engineering in 1940, and is a member of the American Society of Mechanical Engineers and the Technical Association of the Pulp and Paper Industry.

Felix W. Saco

He has been granted several patents for the application of a waste water boiler for internal combustion engines. Some of his past contributions to industry include development of a self descaling sea water still; design of a control valve for aircraft cabin pressurizing and cooling; design work on a nuclear reactor; mechanical design of air-borne infra-red equipment and the design of a heavy type, high-speed, paper-mill winder.

National Lead Announces New Division

National Lead Co. has announced the formation of the *Pioneer Alloy Products Division*, which has taken over the manufacturing operations of the *Pioneer Alloy Products Co., Inc.*, of Cleveland. Pioneer is one of the first producers of stainless steel castings in the country. National Lead is an established manufacturer of lead and lead alloy products, titanium dioxide and titanium metal, the "Dutch Boy" line of paints and pigments, oil well drilling muds, zirconium chemicals and metal, and oils and chemicals for the paint industry.

Manufacturing operations of the new division will be located in Ellwood City, Pa., in a National Lead Co. plant equipped as a foundry and machine shop. The division's production will consist of corrosion-resisting valves, with wide application in the chemical processing and refining industries,

heat-resisting and acid-resisting castings for general industrial use, and chrome-nickel-steel valves now manufactured at National Lead Company's Fitchburg, Mass., plant.

L. J. Gambow, general manager of the Pioneer Alloy Products Company, Inc., will become sales manager of this new division of National Lead Company.

Chase Brass & Copper Co., Inc. Expands Research Activities

Reorganization of research activities of *Chase Brass & Copper Co., Inc.*, a subsidiary of *Kennecott Copper Corp.*, to be included in a new research and development department under the direction of *Dr. D. K. Crampton* has been announced by *Richard C. Diehl*, president of Chase.

This expanded research program is being housed in new quarters at the Chase Metal Works in Waterbury. In addition to present facilities, new scientific devices will be used including an electron microscope, improved X-ray diffraction equipment, a large grating spectrograph and several special melting and heat treating furnaces."

Connected with each of the mills there will be reorganized metallurgical departments; that at Waterbury being under the direction of *B. H. McGar* and the one at Cleveland under the direction of *R. E. Ricksecker*. Dr. Crampton will serve as consultant to both of these. The metallurgical departments will embrace all functions necessary for production control, quality control, analytical control, fuels and furnaces, customer technical service and plant metallurgy.

Peninsular Grinding Wheel Company Appoints Dr. Kistler

The appointment of *Dr. Samuel S. Kistler*, internationally known chemical engineer and world-renowned authority on abrasives, as research associate of the *Peninsular Grinding Wheel Co.* of Detroit, has been announced.

Dr. Kistler resigned recently as director of research for the Norton Company to accept the deanship of the University of Utah College of engineering. He graduated in 1921 from Stanford University where he won his degree as a chemical engineer in 1922, and his doctorate in 1929. He began his business career with Standard Oil of California in 1922. For the next eight years he taught chemistry at the College of the Pacific, and later spent two years studying physical chemistry at the Universities of Berlin and Goettingen in Germany. Upon his return home, he taught chemical engineering at the University of Illinois for four years. During this same period he served as consultant for du Pont. He joined the *Norton Company* research staff in 1935 remaining until this year. The last four years of his association with Norton was as director of research.

Manufacturers' Literature

Internal Grinding Wheels

Simonds Abrasive Co., Dept. MF, Philadelphia 37, Pa.

This firm has issued a new catalog bulletin, Form ESA-29, describing grinding wheels for internal grinding operations. These wheels are manufactured on new, automatic press equipment assuring automatic uniformity of mechanical accuracy and grinding characteristics. Included in the bulletin

are grain and grade recommendations for internal grinding various materials and tables of standard sizes and shapes up to 2½" diameter. Copy of this bulletin is available upon request.

Barrel Plating and Processing

Frederic B. Stevens, Inc., Dept. MF, Detroit 16, Mich.

A completely new bulletin on the Stevens automatic barrel plating and processing machine is now available. Complete descriptions of both the "C" and Super "E" models are included and several recent engineering developments in the field of automatic barrel plating are described and pictured.

The bulletin describes several special applications for this automatic barrel machine in detail and pictures of its use for the phosphate coating of mortar shells and washing of small parts are included.

Readers may obtain a copy by writing to the above address. Request Catalog No. 60.

Copper-Oxide Rectifier Stacks

General Electric Co., Dept. MF, Schenectady 5, N. Y.

A new 8-page, two-color booklet describing the basic characteristics and applications of copper-oxide rectifier stacks has been announced as available.

Designated as GEA-5699A, the booklet is complete with charts, graphs, and tables illustrating the characteristics, manufacture, circuit design, and application of copper-oxide rectifiers.

Zeolite Water Softeners

The Permutit Co., Dept. MF, 330 West 42nd St., New York 36, N. Y.

Troubles caused by the utilization of hard water and the multiple economies effected by curing them are thoroughly discussed in a comprehensive 16-page bulletin (No. 2386), issued by the above company.

The bulletin lists several industries in which steam and water are of importance. It explains the three basic types of ion-exchange equipment and shows how these units can be profitably utilized.

New Finishing Engineer Screens Metalworking Field

Metalwash Machinery Corp., Dept. MF, Elizabeth, N. J.

Directed to the attention of plant operators in the metalworking industry is a new quarterly magazine, entitled *Finishing Engineer*. Metalwash Machinery Corp., designers and manufacturers of industrial washers, announced publication of the first issue for October. Containing articles of interest to the metal finishing industry, *Finishing Engineer* will survey operations throughout the country which involve the cleaning, pickling and drying of metal parts. Also listed in the table of contents will be discussions and illustrations of the application and maintenance of industrial washers, together with articles reviewing the selection and application of cleaning and finishing materials.

Featured in the first issue will be

the story of "Automation," Ford Motor Company's modern approach to mass production.

Steam Cleaner Brochure

Kelite Products, Inc., Dept. MF, 1250 North Main St., Los Angeles 12, Calif.

America's most powerful cleaner is pictured and fully described in a new, free brochure on the *Kelite Power-Master* steam cleaning machine. Designed for heavy duty, the *Power-Master* has a rated steam capacity of 300 gallons per hour plus the exclusive Power-Blast rinsing-washing feature which delivers 1,000 gallons of hot or cold water per hour at a pressure of 500 p.s.i.

The unit is equipped with two or three steam guns, as desired, and the Power-Blast water gun. Other features described in the new literature include Aerated Gun Grips which stay cool, permit working without gloves, and the Hy-Vel Nozzle which concentrates the cleaning blast in the area to be cleaned. Also covered is the radically different piston-type pump used in the cleaner.

Free copies of the brochure may be obtained by writing the manufacturer. Ask for Bulletin 125.

Nickel Plating

International Nickel Co., Inc., Dept. MF, 67 Wall St., New York 5, N. Y.

The above company has made available the following literature: *High Speed Nickel Plating*—8 pages, 10 illustrations and charts. Gives the results of investigations of plating deposits of .001" to .003" in eleven minutes (at current densities of 100 to 300 amperes per square foot). Deposits exhibited equal corrosion resistance and compared in smoothness, buffing and mechanical characteristics with deposits from a Watts type bath. Plating solutions and procedures are given.

Hydrogen Peroxide in the Purification of Plating and Other Metal Salt Solutions

Becco Sales Corp., Dept. MF, Station B, Buffalo 7, N. Y.

"Purification of Metal Salt Solutions with Hydrogen Peroxide" is the title of a bulletin No. 26 issued recently by the Buffalo Electro-Chemical Co., Inc., Buffalo, N. Y., which gives complete directions for isolating metal salts from process solutions. Among the several purposes outlined for this process is the purification of electrolytic nickel-plating solutions with hydrogen peroxide.

The bulletin gives complete directions for isolating metal salts from process solutions used for the following purposes: Electrolytic Nickel Plating; Beryllium Production; Magnesium Production; Phosphating and Tin Recovery from Non-Ferrous scrap.

The bulletin No. 26 may be had by writing to the above address.

Fluoborate Solutions

General Chemical Division, Allied Chemical & Dye Corp., Dept. MF, 40 Rector St., New York 6, N. Y.

The above firm has recently prepared a booklet "Baker & Adamson Metal Fluoborate Solutions," which will be of interest to all industries doing electroplating.

The new booklet outlines how these

versatile plating solutions are being used in scores of applications to speed up output, cut operating costs and save scarce metals. Also included are data on the chemical and physical properties of the various B&A Fluoborate concentrates.

Copies are available by writing to the above address.

Multiple Burner Protectoglo Systems

Minneapolis - Honeywell Regulator Co., Brown Instruments Div., Dept. MF, Wayne and Windrim Aves., Philadelphia 44, Pa.

Bulletin 9603 contains data on combustion safeguard systems for industrial ovens, furnaces and other heat treating applications fired by multiple oil or gas burners. Bulletin describes system components, lists light-off options available and includes dimensional and operational data.

Automatic Voltage Stabilizers

General Electric Co., Dept. MF, Schenectady 5, N. Y.

A new 12-page, two-color bulletin on automatic voltage stabilizers ranging from 15 to 5,000 volt amperes has been announced as available.

The booklet (GEA-5754) contains photographs and diagrams of the equipment, explains operation principles and construction, and gives complete specifications. It also describes the causes and effects of voltage variations and lists typical applications for stabilizers.

Safety Catalog

The Boyer-Campbell Co., Dept. MF, 6540 St. Antoine St., Detroit 2, Mich.

A 144 page catalog titled "Everything for Safety" is announced by this firm. It describes face shields, welding helmets, "Supersight," "Skin-Cote" liquids and creams for protection against skin infections—safety clothing, machine guards, etc., anything required for a comprehensive safety program. A request on your letterhead will bring it to you without charge and postpaid.

New "Gripper" Sling Catalog

The Cambridge Wire Cloth Co., Dept. MF, Cambridge, Md.

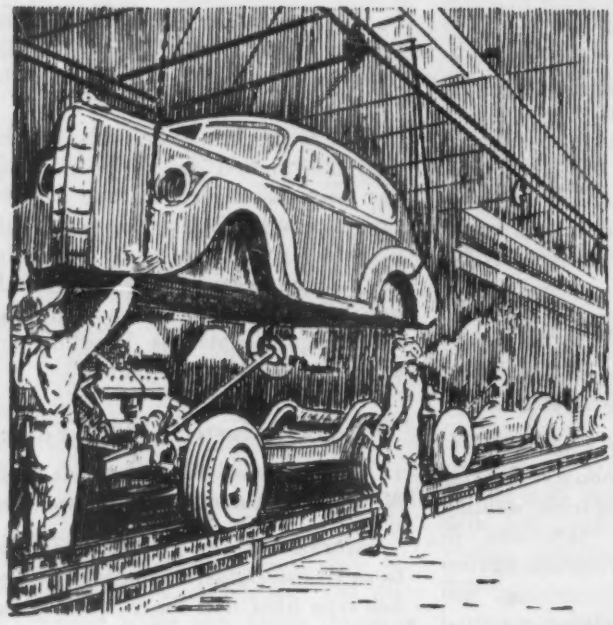
Included in its 15 pages is complete data on the three major specifications to which the slings are made, information on recommended uses and loading data, and full listings of prices for standard sizes.

This is the first time that all pertinent information on "Gripper" slings has been assembled in one booklet. Copies may be obtained by writing the manufacturer direct, or by contacting distributing organizations handling the line. "Gripper" slings are sold through mill supply, materials handling and safety equipment distributors.

Delpark Industrial Filter Folder

The Industrial Filtration Co., Dept. MF, 528 Industrial Ave., Lebanon, Ind.

Information on industrial applications of the Delpark industrial endless belt-type filter and the Delpark industrial disposable-type filter is now available. Included is information on the sizes, capacities, and performance characteristics of these filters. Physical construction, specifications and ratings, and dimensions are also included. Coolant filtration as well as industrial applicators are illustrated showing various uses.



MOTOR CITY PLATING NEWS

by

Edward Finne

Wyandotte Chemicals Adds Two to Detroit District Service Force

Franklin F. Roberson and *Arthur J. Medwedeff* have recently been added to the Industrial Sales Department of the Detroit District of *Wyandotte Chemicals Corp.* Mr. Roberson will headquarter in Detroit; Mr. Medwedeff in Flint.

Mr. Roberson is a graduate of General Motors Institute of Technology. His plating, polishing, and buffing experience totals 14 years as a Foreman --10 with *Ternstedt Manufacturing Co.* and one with *Ainsworth Manufacturing Co.* In addition, he has 6 years of sales-service experience.

Mr. Medwedeff holds a masters degree in Chemical Engineering from University of Michigan. He has been

Franklin F. Roberson

Arthur J. Medwedeff

employed by *Buick Motors, AC Spark Plug,* and the *U. S. Bureau of Mines.* He has had considerable experience in the control of electroplating solutions and in analysis of greases and metals.

Both new Wyandotte representatives attended training schools at the Company's research and technical service laboratories, and were given intensive field training before being assigned to their territories.

Promotions

Stephen T. Orr, vice-president of *Wyandotte Chemicals Corp.* and for twenty-five years in charge of the company's manufacturing and operating activities, has been made a member of the president's staff with the rank of vice-president, *Robert B. Semple,* president, announced recently.

He is succeeded in his manufacturing responsibilities by *Frank Wolcott,* his immediate assistant, who becomes general manager of manufacturing, Michigan Alkali Division.

Mr. Orr, who joined Michigan Alkali in 1906 when he was graduated from Michigan State College, succeeded his father, William T. Orr, as general manager.

Mr. Wolcott joined Wyandotte two years ago as general manufacturing manager, having come to Wyandotte from the *New Jersey Zinc Co.*

In his new capacity in charge of Michigan Alkali Division operations, he will report to Mr. Semple and will directly supervise the North, South, Kreelon and Glycol plants, in Wyandotte; the Calvert, Kansas and Blue Mountain, Mississippi plants; the Alpena Quarries, and the steamship and coal mining subsidiaries of the company.

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The *Detroit Rubber Co.* has moved its executive offices and plant from 5060 Edwin to 9370 Roselawn, Detroit 4, Mich.

The company was founded by *Edwin J. Post, H. Clifford Taylor* and *Harriette N. Staff* two years ago. Al-

though it is a comparatively new company, the members have been in this same field for the past 16 years in the Detroit area.

Products manufactured by the company are molded goods of rubber, Neoprene, Buna S, Buna N, and silicone. Plating tanks, drums and other rubber and synthetic rubber products are lined and fabricated for the chemical and metal finishing trades in this new plant which has more than twice the area and capacity of the former plant.

****

The Detroit section of the *Society of Plastics Engineers, Inc.* held a technical meeting on the 19th of September at the Rackham Building.

Following dinner, *Thomas Comer*, field manager, *Distillation Products Industries, Division of Eastman Kodak Co.*, gave a very interesting and informative talk on "High Vacuum Metallizing" which was supplemented by color and black and white slides.

****

The Detroit branch of the *American Electroplaters Society* held its October meeting on Friday, Oct. 3rd at the Statler Hotel.

Bill Phillips of *General Motors* gave the principal address of the evening and spoke with great authority on the current metal shortages as viewed from the Washington scene. Mr. Phillips is well qualified to talk on this subject inasmuch as approximately half of his time is now spent in Washington where he is doing much work with the NPA.

A film on deep sea fishing, "Bimini Varieties" was shown.

The following new members were elected to membership: *Walter Byers, Virgil Coffman, B. E. Drury, Harlan Felsner, Richard Gray, Robert Hamilton, Carl Jackson, Mitchell Kafarski, Paul Spencer* and *Arthur Schneider.*

The meeting was adjourned to allow the members to participate in the liquid refreshments.

****

News from California

By Fred A. Herr

Atlas Plating Company has plans under way for a 50,000 square foot addition to its plant at Slason and Hooper Avenues, Los Angeles, according to an announcement by *Henry Puckett*, president.

The addition, according to Mr. Puckett, is part of an overall expansion program involving construction of a number of new buildings at a total outlay of approximately $250,000 for buildings and equipment.

New equipment for the 50,000 square foot addition includes tanks for hard chromium, cadmium and zinc, facilities for tumbling and polishing, and manual as well as automatically operated ornamental production plating. Solution tanks for practically every type of plating will be installed. Atlas Plating Company does a heavy volume of work for the *Douglas Aircraft Company*.

Cee-Bee Chemical Co. of Los Angeles, manufacturers of industrial cleaning compounds, has announced plans for construction of a 15,000 square foot factory in Downey, Calif. The new plant, completion of which is anticipated by the end of 1952, will house the firm's manufacturing operations now centered in Los Angeles. Research and laboratory facilities will remain at the Los Angeles address.

Don N. Bedwell, superintendent of the *Hallenscheid-McDonald Co.* Los Angeles, and *John Merigold*, retired, compared notes on their respective longevity in the plating business at the October meeting of Los Angeles AES branch, when John happened to mention that his 79th birthday was only a few days away. Don stated that his plating activity covered 47 years and challenged John to match that record.

John did—with five years to boot. He started in 1893 in the shop of the *Cohanet Nicket Plating Co.* which his father operated in Taunton, Mass. His first job was sweeping the floor. The shop specialized in nickel plating stove parts. His retirement came 52 years later (1945) when he sold a precious metal plating shop in downtown Los Angeles and retired to a life of semi-rural ease in the San Gabriel Valley, northeast of Los Angeles.

He operated the *Merigold Electro-Plating Company* in Newark, N. J. until he migrated to Los Angeles in 1921. His first venture on the West Coast was as a manufacturer of lighting fixtures. He re-entered the finishing business as a plater for *Joseph's* exclusive Hollywood manufacturing jeweler, and subsequently opened his own shop in downtown Los Angeles.

Since his retirement in 1945 John spends his time "farming" on a half-acre not far from the famous Santa Anita racetrack, where he says he grows most of his own vegetables. His contacts with old friends in the plating industry are maintained through occasional trips to Los Angeles to attend the monthly meetings of the AES.

C. E. Devine, formerly manager of

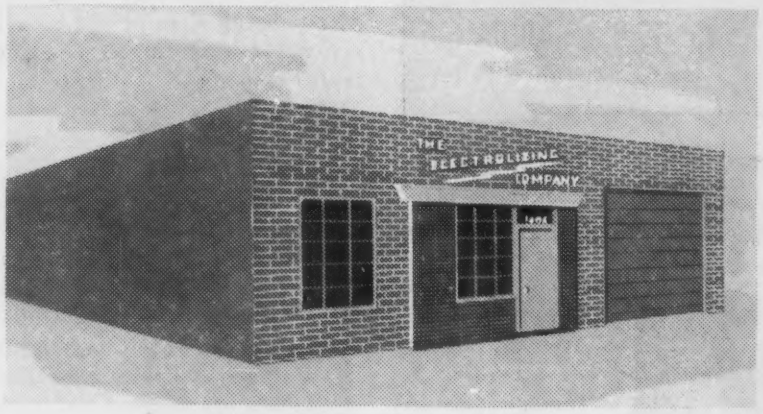
the Chicago branch of *Turco Products, Inc.*, has been appointed director of public relations, with headquarters in The Los Angeles main office. *F. E. Warnes*, advertising and publicity director for the past five years, resigned recently.

Marshall Bland, process engineer attached to the Dallas, Tex., office of *Turco Products Inc.*, spent two weeks at the Los Angeles home plant in October to participate in an indoctrination course which the firm annually sponsors for members of its technical staff.

Norman Pintshuk, formerly with the research division of *International Harvester Co.*, Chicago, has been appointed foundry metallurgist in the stainless steel division of *Solar Aircraft Co.*, San Diego, Calif.

Electro-Coating Co. has moved from 4977 Branyon St. into a larger plant at 5523 Chakemo St., South Gate, Cal. The firm specializes in chromium plating operations.

Electrolizing Co. Revises Corporate Setup



Concurrent with the opening of its new model plant at 1406 E. 15th St., Los Angeles, Cal., *The Electrolizing Co.* completed a revision of its corporate setup whereby separate divisions have been created, one for processing and manufacturing, the other for marketing and sales.

David B. Grant, president and general manager, announced that, effective September 1, the Electrolizing Co., an individual proprietorship owned by himself, became

(1) *The Electrolizing Co.*, a California corporation, which holds the exclusive license rights to the Electrolizing process in the thirteen western states, and which will confine its activities to manufacturing and processing.

(2) *Electrolizing Sales & Tools, Inc.*, also incorporated under the laws of California. This division will handle marketing and sales for The Electrolizing Co. of Electrolized taps, drills, reamers and mills and cut-off blades; and marketing and sales of the *Empire Tool Company's* cutting-off tools and floating tap and reamer holders.

The new plant has been equipped with complete metal cleaning facilities.

including vapor-blasting, and special power equipment and electronic controls. The plant contains one complete unit for Electrolizing rifle barrel bores and four other electrolizing units.

The Los Angeles facility of Electrolizing Company is the only electrolizing plant in the 13 western states, but plans are being made, Mr. Grant announced, for establishing additional plants in the San Francisco Bay, Portland-Seattle, and Texas Industrial areas.

NEW BOOK

Metallurgy for Engineers

J. Wulff, H. F. Taylor & A. J. Shaler. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $6.75. 598 pages, plus appendix.

The authors, all on the staff at M.I.T., have based this book on material used in their engineering course. They have attempted, quite successfully, to instruct the reader in the processing of metals from ingot to finished product, both the principles and practices involved. Although the ideas and illustrations are simple and clear and an understanding of the subject matter will be of value in the specification of materials and their proper use, the book would not be considered of value to the shop man but rather to the engineer. It is a text book rather than a reference volume and, with excellent line drawings by G. E. Schmidt, Jr. to illustrate the text, engineers will find the material excellent for refreshing their memories on basic metallurgy and for bringing them up to date on new concepts.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Philadelphia Branch

The Philadelphia Branch will hold its Annual Educational Session and Banquet in Philadelphia Saturday, November 22. The Educational Session will be held at 1:30 p.m. at which the following papers will be given.

"Nickel Plating—Today and Tomorrow." By *Dr. R. B. Saltonstall*, Technical Director, *Udylite Corp.*

"Practical Aspects of Zinc and Cadmium Plating." By *Mr. Edwin F. Ottens*, Chemical Engineer, *Philco Corp.*

"Periodic Reverse and Ultra-Sonic Cleaning." By *Dr. W. L. McCracken*, Director of Research, *Detrex Corp.*

The Banquet will be held at 7:00 p.m.

Indianapolis Branch

On October 1st, 1952 thirty-four members and guests enjoyed a steak dinner at Fox Steak House. At eight o'clock, six additional members joined the group for the business meeting and program. The secretary read her report and it was accepted. The treasurer's report was given and it was accepted and filed.

Since the branch has a balance of $2,194.51 in the checking account, much discussion took place as to what to do with it. *Cliff Gough* made a mo-

tion the executive committee take under advisement the condition. This was seconded by *Herb Kennedy*. The motion was amended by *Dr. A. M. Max* that the committee report back to the membership at a subsequent meeting. The motion was carried.

Discussion followed as to the $1.00 assessment per member to be used for research committee. The three delegates, *Tom Evans*, *Dr. A. M. Max* and *Ed Bruck* are to vote on the issue. A motion was made by Ed Bruck that the branch go on record to instruct the delegates to vote in favor of $1.00 increase in dues for research. This was seconded by Dr. A. M. Max. A vote was taken by raising hands with a result of twelve for and eight against. The motion was carried.

The program for the meeting which was to be a discussion on "*Generators vs. Rectifiers*" with Ed Bruck as moderator was postponed until November. This was in the form of a motion by *Bert Hawhee* and seconded by *Vince Kelly*.

Mr. Raymond Shock, executive secretary of *National Association Metal Finishers*, Washington, D. C. was a guest and speaker. He told of his work with the association. He devotes all his time to the job and he has information of how association gives aid to platers nationally. He also investigates various situations which arise in business of plating, also digs into government regulations. He reported that 3,527 questionnaires were sent to plating industries and shops. His biggest problem is to inform the people where they can get certain types of plating done.

At 9:30 p.m. the meeting adjourned and refreshments were served.

Pittsburgh Branch

The *Pittsburgh Branch* held its first meeting of the year at the Sheraton Hotel on September 11, 1952. A group of twenty-five members enjoyed a particularly delicious fried chicken dinner prior to the business meeting at which forty-two members and guests were present.

The various officers gave their reports on the activities which took place during the summer and the progress of the activities which are being planned for this year.

Treasurer, *Damon Antel*, informed us that we still have twenty-one delinquent members and president, *Rex Goldbach*, urged that all delinquents should make an effort to pay their dues since it is unfair for the balance of the Branch to pay the per capita tax for these delinquents.

Librarian, *G. S. Woodruff*, read the list of speakers and subjects for the year and everyone present agreed that the subjects to be presented form a well rounded program.

Membership chairman, *Bob Varner*, has asked the entire Branch to serve on his committee. It is the duty of every member to be as active as he possibly can in Branch activities. If every member brought a new man into the organization the results are quite evident.

Three new members were welcomed into the Branch. They are: *Harry L. Flister*, Wyandotte Chemical; *W. F. Pizoli*, Oakite Products; and *Charles Galba*, Gogals Modern Products Co.

Glenn Herring, chairman of the Milwaukee Night, has investigated a number of possible places to hold the party. After the merits of the various hotels were discussed, it was decided to hold the party at the Fort Pitt Hotel on the second Saturday of November. This

date, as we all realize, is a little early for a holiday party but we have discovered in the last few years that the weatherman does not cooperate with the Pittsburgh Branch at their December parties.

Sam Johnson gave a brief report of the Chicago convention at which approximately fifty-five of our members were present. It was quite apparent that the convention was a considerable success.

The librarian asked one of the guests, *Dr. A. K. Graham*, to introduce the speaker since Dr. Graham has been a close friend of the speaker for years. *Maurice R. Caldwell* of the Doehler-Jarvis Corp., Grand Rapids, Mich., presented an interesting talk on "Comparative protection obtained by various thicknesses of copper and nickel upon zinc, aluminum and magnesium die castings." The speaker had various lots of test panels which had been plated by varying methods and these panels were given exposure tests at Detroit, Pittsburgh, Miami and Grand Rapids. By the use of slides, Mr. Caldwell was able to show the advantages of various combinations over different alloys. The following factors were most prominent in affecting the rate of corrosion: 1) Base-metal chemical composition; 2) thickness of plate; 3) atmosphere. A very interesting question period followed the main lecture and the number of questions presented plus the manner in which they were answered was most indicative of a successful technical session. The members enjoyed themselves after the meeting by partaking of refreshments and in informal discussions.

Louisville Branch

The regular monthly meeting of the *Louisville Branch, American Electroplaters' Society* was held Thursday, September 18, 1952 at Korfhage's Restaurant, 1482 Preston St., Louisville, with a dinner served at 6:30 P.M. President *Arthur A. Oertel* opened the business and open meeting at 8:00 P.M. with thirty-four members and guests present.

The roll call of officers was read and first vice president *P. H. Pate*, sergeant-at-arms *Paul DeHaven* and board of managers *Albert Steidle*, were reported absent. The minutes of the previous meeting were read and accepted. The Membership Committee reported three applications and balloting for membership.

Applications for membership were received from *Kenneth C. Reifsteck, Norman W. Johnson* and *William W. Francis*.

A letter was read from *Charles Wise*, secretary of the Cincinnati Branch, A.E.S. regarding improved facilities and air conditioning in the lecture rooms and the housing of the Industrial Finishing Exposition which are held in the month of June of each year at the National Convention. A discussion followed and, by a vote, the letter was ordered to be placed on file.

S. J. Beyer gave a brief report of the Convention which was held in Chicago June, 1952. Louisville branch had a good representation at the Convention. Comments were also offered by *Ed Bruck* of the Indianapolis Branch.

President *Arthur Oertel* turned the meeting over to Technical Sessions Chairman, *S. J. Beyer* who, after a brief talk, introduced the speaker of the evening, *A. H. Kirkpatrick* of the *F. B. Stevens Co., Inc.*, Detroit, Mich.

Mr. Kirkpatrick in his talk on the subject of Material Handling, Plating

and Phosphatizing of small Parts, explained the superiority of the automatic barrel plating machine as compared to the hand barrel plating by saving in labor from 40 to 60%. In the film, "Industrial Albums," the picture shows the efficient operations of the barrel plating machine with its tremendous capacity and the flexibility of adjustment to plate any desired thickness. Considerable discussion followed and Mr. Kirkpatrick was given a rising vote of thanks for a very interesting talk and picture.

Cincinnati Branch

The *Cincinnati Branch* of *The American Electroplaters' Society* opened the 1952-53 season with a very healthy turnout on September 24th for both the usual tasty dinner and the business meeting which followed. We were extremely happy to welcome seven guests from the local Ford Motor Company's Automatic Transmission plant who we hope will be active members of our branch.

President *Robert D. Miller* opened the meeting by introducing our various guests and then brought to the membership's attention the new charges which will be made for the use of our meeting place, the Engineering Society of Cincinnati's headquarters. It was felt that it would be advisable for a committee to study this matter and, accordingly, *Charles T. Nuzun* was appointed as Chairman with Messrs. *Richard Evans* and *Jos. Judman* as other members of the committee.

Since the Librarian elected in March had left Cincinnati, it was necessary to appoint a successor. The nominating committee, after lengthy and diligent search brought in the name of *Charles R. Sorber* who was unanimously elected to perform this most important function.

A discussion was then led by *Charles Wise* on the possibility of a Regional Educational Meeting and Dinner Dance in Cincinnati to be held after January 1st. The costs of a meal, orchestra, floor show, waiters, etc., were presented as well as the contributions which could be expected from suppliers. *Harvie Johnson* of *Belke Mfg. Co.*, Chicago, felt that they could be asked for $25.00. Mr. Wise was asked to ascertain when Dayton and Indianapolis would hold their meetings after which *Del Taylor* moved, seconded by *R. Evans*, that we hold such a meeting.

The Secretary presented the membership transfer of *Roger Slater* from Grand Rapids. Then he offered his letter of September 8, 1952, addressed to the Board of Directors of the A.E.S., Branch Secretaries and Exhibitors asking that the annual conventions be changed to Spring or Fall so that cooler weather would be experienced. Mr. Wise moved that the Branch go on record as favoring this recommendation, which was seconded by Martin Gannon and passed.

We were then shown some unusual pictures of World War II which were presented by Harvie Johnson whose company then were hosts for the regular Social Hour.

Los Angeles Branch

The discovery, development and current uses of hard anodizing of aluminum were discussed in a talk before the October 8th meeting of Los Angeles Branch of the *American Electroplaters' Society* by *Paul Craig* of the *Manco Plating Co.*, Los Angeles.

Mr. Craig has had many years experience in the metal finishing industry, most of which have been concen-

trated on finishes for aluminum. Prior to joining Manco Plating Company, he served as technical supervisor for the *Aluminum Company of America*, and had also operated his own shop in Indianapolis, Ind.

His practical experience in the use of aluminum hard anodizing processes made it possible for him to present an exceptionally complete discussion for the benefit of the 80 members and guests who attended the Los Angeles meeting in Rodger Young Auditorium.

Preliminarily, he discussed the discovery and characteristics of the hard anodizing process. Of the two practical processes for anodizing aluminum, the speaker said that the chromic acid procedure is the oldest and was developed as a method of preventing corrosion by salt atmosphere. Between 1921 and 1930 this process was principally confined to the aircraft industry, according to Mr. Craig.

Development of the sulphuric acid anodizing process occurred around 1929, Mr. Craig said. The finishes produced by the two methods, he declared, are relatively the same, both falling under the heading of aluminum oxide.

The cost of power, Mr. Craig stated, is possibly the greatest deterrent to a wider use of hard anodizing of aluminum. He estimated that the same source of power would produce 100 parts in gray anodizing, 40 parts in Alumilite ing and only about 5 parts in hard anodizing.

The speaker next addressed himself to possible applications of the process of hard anodizing of aluminum.

"There are any number of applications for hard anodized films," he said. "The major interest in the process has been among those producing aircraft valves and components of aircraft, particularly for parts where it is essential that the pieces maintain their dimensional tolerances.

"In hard anodizing the finish is so hard that when other hard materials, such as iron or steel are abraded against them, the hard anodized film remains unaffected."

Branch president *Myron Orbaugh* of the *Bone Engineering Co.* presided over the business session. Guests introduced by sergeant-at-arms *George Hetz* included the following: *Jerry Hinshaw*, North American Aero Physics; *Robert* Baker, Baker Metal Finishes; *Ray Klotz*, Anodite, Inc.; *Gordon Jackson*, Anachrome Co.; *Marshall Bland* and *Robert Stewart*, Turco Products, Inc.; and *Bert Muse*, Manco Plating Co.

Larry van Osdell, *Bert Sherwood* and *Robert S. Schwartz* were initiated into membership. Applications for reinstatement, received from *William Nairn* and *M. J. Noblitz*, were approved. The applications for membership from *James M. Soule* of Federated Metals, Inc., and *E. M. Baker* of Alert Supply Co. will be acted upon at the November meeting.

Richard Wooley, one of Los Angeles Branch's three delegates, presented a report about a resolution submitted at the Chicago convention under which it is proposed to increase AES dues by $1.00 per year, with the increase to be used exclusively for the research fund. Wooley requested the branch to express its opinion by vote so that the delegates would be informed on how to vote on the resolution. Upon motion of *Jack Beall*, seconded by *Earl Coffin*, the membership instructed the delegates to vote in favor of the resolution.

Wooley, *Walter P. Behlendorf* and *Roy Lostutter* then gave a report of

Chicago convention activities. Wooley reported on the business sessions and exhibits; Behlendorf on the educational phases and technical papers; and Millhorn on the exhibits and social phases. One of the enjoyable social affairs, Millhorn reported, was a breakfast which *Roger Sundmark* of the Sundmark Supply Co. hosted for all persons attending the convention from California.

President Orbaugh announced that it has become necessary to seek a new location for the 1952 annual educational session. He delegated *Harold Kroesche* to make inquiries to that end, and also to investigate the possibilities and availability of facilities in the new Statler Hotel.

AMERICAN SOCIETY FOR TESTING MATERIALS

The *American Society for Testing Materials*, through its President, *Harold L. Maxwell* (E. I. du Pont de Nemours and Co.) has announced the election of *Robert J. Painter* as Executive Secretary of the Society and of *Raymond E. Hess* as Associate Executive Secretary and Editor in Chief.

This action was taken by the Board of Directors following a report of a special committee which had been appointed to recommend a successor to the late *C. L. Warwick*, long-time Executive Secretary of the Society, who died suddenly April 23.

Both men have been members of the ASTM for many years. Mr. Hess has been Assistant Executive Secretary and Editor, and Mr. Painter most recently has been Treasurer and Assistant Secretary.

Galvanizers Meeting in Chicago

The fall meeting of *The Galvanizers Committee*, sponsored by *American Zinc Institute*, will be held at the Bismack Hotel, Chicago, Ill., on Thursday, Friday and Saturday, November 20-21-22.

According to *J. T. Mayhew*, Weirton Steel Co., chairman of the governing board, the highlight of the meeting will be an all day inspection trip of the Inland Steel Co., Indiana Harbor Plant on Friday.

R. J. Stoker, U. S. Steel Co., and his program committee have announced that at the closed sessions on Thursday morning and Saturday morning, subjects of interest to operating and technical men will be discussed. On Thursday afternoon, an open meeting has been scheduled when qualified speakers will discuss several angles of the industry's fabricating and marketing problems.

Before the close of the meeting, successors will be named to fill the places of the two retiring members of the Governing Board which now consists of *J. T. Mayhew*, Weirton Steel Co., Chairman; *F. F. Aloi*, Bethlehem Steel Co.; *N. E. Cook*, Wheeling Steel Corp.; *B. P. Kinkbone*, Armco Steel Corp.; *C. H. Fitzwilson*, Columbia-Geneva Steel Div.; *R. S. Gentz*, Inland Steel Co.; *F. G. White*, Granite City Steel Co.

INSTITUTE OF METAL FINISHING

AWARD OF WESTINGHOUSE BRAKE & SIGNAL CO'S PRIZE:

The Council of the Institute of Metal Finishing announced that on the recommendation of the Publications Committee, the Westinghouse Brake &

Signal Co. Ltd's prize was awarded to Mr. W. A. Marshall for his paper on "Non-Electrolytic Smoothing Treatment for Steel."

The prize was formally awarded at the Annual Autumn Meeting at the Grand Hotel, Birmingham, on Wednesday, 22nd October, 1952.

OBITUARIES

GEORGE G. KNECHT

George G. Knecht, District Manager for the *Hanson-Van Winkle-Munning Co.*, Matawan, N. J., died suddenly of a heart attack at the Race Brook Golf Club, New Haven, Conn. on October 8. He was 68 years old.

Mr. Knecht spent his entire business life in the electroplating industry and was well known throughout the

field. He had been with Hanson-Van Winkle-Munning for some 30 years having started with the old Hanson & Van Winkle Co. He was a past officer of the *American Electroplaters' Society* and a member of *Hejaz Grotto*.

Mr. Knecht made his home in New Haven, Conn. and is survived by one son and one daughter.

FRED H. HAGGERSON

Fred H. Haggerson, chairman of the board of *Union Carbide and Carbon Corp.*, died at the Roosevelt Hospital, New York City, on October 14th after a short illness. He was 68 years old.

F. L. CURTIS

Frederick L. Curtis, retired vice-president of *Raybestos-Manhattan, Inc.* and former general manager of the *Manhattan Rubber Division*, died September 20 at his home in Passaic, N. J. He was 84 years old.

Mr. Curtis was believed to be the oldest pioneer in the American rubber industry, having started as a shipping room boy with the *New York Belting & Packing Co.* 70 years ago in Sandy Hook, Newtown, Conn.

He was the last of the pioneers who were officers or employees of The Manhattan Rubber Mfg. Co. when it began operations in Passaic in 1894.

Mr. Curtis came to Passaic from Sandy Hook in 1893 as office manager at the request of Col. Arthur Farragut Townsend, one of the founders of Manhattan Rubber. As the company expanded, he held successively many titles and positions. He became secretary of Manhattan Rubber in 1903, a director in 1912 and a vice-president in 1913. In 1916 he became senior vice-president and assistant general manager. In 1929 at the merger to form Raybestos-Manhattan, Inc., he became treasurer and later vice-president. In 1940, upon the death of Col. Townsend, he became general manager. Later he began to relinquish his active duties until his retirement on October 1, 1950.

Mr. Curtis was also one of the founders and first president of the *New Jersey Engineering & Supply Co.* at Passaic.

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1—New General Electric Copper Oxide Rectifier 1250 amperes at 9 d.c. volts with a separate control.

1—Chas. J. Bogue 5000/2500 Amp. 8/16 d.c. Volts generator with a Fairbanks-Morse 50 HP motor 400 R.P.M. 3/220/60/AC.

2—25 HP motor in head polishing lathes, Heavy Duty.

10—U. S. Model 95 Variable Speed Buffing and Polishing Machines, 5 H.P. 3/220/60/AC.

1—Crown Tumbling Barrel Two Compartment with New wood linings 44" x 36" equipped with 3 H.P. motor and controls.

1—Acme Semi-Automatic Buffing Machine A2D — two spindle with follower attachment.

1—Complete Chrome Anodizing unit consisting of 1000 ampere 40 volt Chandeysson motor generator set, 3 fifteen foot tanks, 2 twelve foot tanks, one sealing tank, one drying tank, steam coils, thermostats, etc.

5—Hobart 100-125 Amp. 6-7½ D.C. Volts, 1 H.P. 1750 RPM 1/110/220/60/AC or 3/220/440/60/AC motor.

1—2000 Amp. 6 volt Chas. J. Bogue motor generator set outside excited, with 20 HP D.C. motor.

2—Abbott Horizontal Tumblers wood lined 36" diameter complete with 3 H.P. gear reduced motors.

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PLATING MOTOR GENERATOR SETS (REBUILT) WITH COMPLETE PANEL EQUIPMENT — MOTORS — 3 PHASE, 60 CYCLE, 220/440 VOLT.

1—HANSON VAN WINKLE MUNNING 5000/2500 amperes, 6/12 volt, interpole, separately excited, 450 RPM, synchronous motor. Ser. #7886.

1—EAGER ELECTRIC 5000/2500 amperes, 6/12 volts, 514 RPM, separately excited. Ser. #1844.

1—HANSON VAN WINKLE MUNNING 2000 ampere, 18 volts, 850 RPM. Separately excited Synchronous, Ser. #7719.

1—CHANDEYSSON ELECTRIC 1500/750 ampere, 9/18 volt, interpole design, 900 RPM, synchronous motor with exciter in head. Ser. #31203.

1—COLUMBIA ELECTRIC 1500/750 ampere, 6/12 volt, interpole design, 1200 RPM, exciter in head. Ser. #4545247.

2—BOGUE ELECTRIC 1000/500 ampere, 6/12 volt, interpole design, 1165 RPM, exciter in head. Ser. #'s 2014 & 2015.

1—ELECTRIC PRODUCTS 500 ampere, 9 volts, 900 RPM, separately excited.

FOLLOWING SETS SYNCHRONOUS—3 phase, 25 cycle, 220/440 volts — COMPLETE.

1—ELECTRIC PRODUCTS 1500/750 ampere, 6/12 volts, 375 RPM, Exciter in head, 25 Deg. C. Ser. #291195.

1—CHANDEYSSON ELECTRIC 3000/1500 ampere, 6/12 volts, 375 RPM Exciter in head. 40 Deg. C, Ser. #26174.

POLISHING LATHES — NEW AND USED — CONSTANT AND VARIABLE SPEED, SINGLE AND DOUBLE MOTOR DRIVES — 3 PHASE, 60 CYCLE, 220/440 volts, 1 to 20 H.P. — IN STOCK.

REBUILT RECTIFIERS — GREEN — UDYLITE — GENERAL ELECTRIC — SELENIUM — 50 to 6000 ampere sizes, 6/12 volt, with regulators, 3 phase, 60 cycle, 220/440 volt.

1—BELKE 14" x 30" motor drive double cylinder mechanical plating barrel for cyanide solutions.

MERCIL — CROWN — BAIRD — LA-SALCO — size #1 and #2 — ball burnishers.

BAIRD — GLOBE — oblique tumblers.

NEW SELENIUM RECTIFIERS, complete with instruments, starter and built-in voltage regulators—

6—1500 ampere, 0-12 volts.

5—1500 ampere, 5-12 volts.

4—2000 ampere, 0-6 volts.

ALSO AVAILABLE — OTHER NEW AND USED POLISHING LATHE, BARRELS, RHEOSTATS, RECTIFIERS, FILTERS, BLOWERS AND GENERATOR SETS. WE CARRY A COMPLETE LINE OF NEW AND USED PLATING AND POLISHING EQUIPMENT AND SUPPLIES.

CLINTON SUPPLY COMPANY

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